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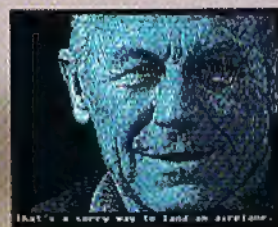
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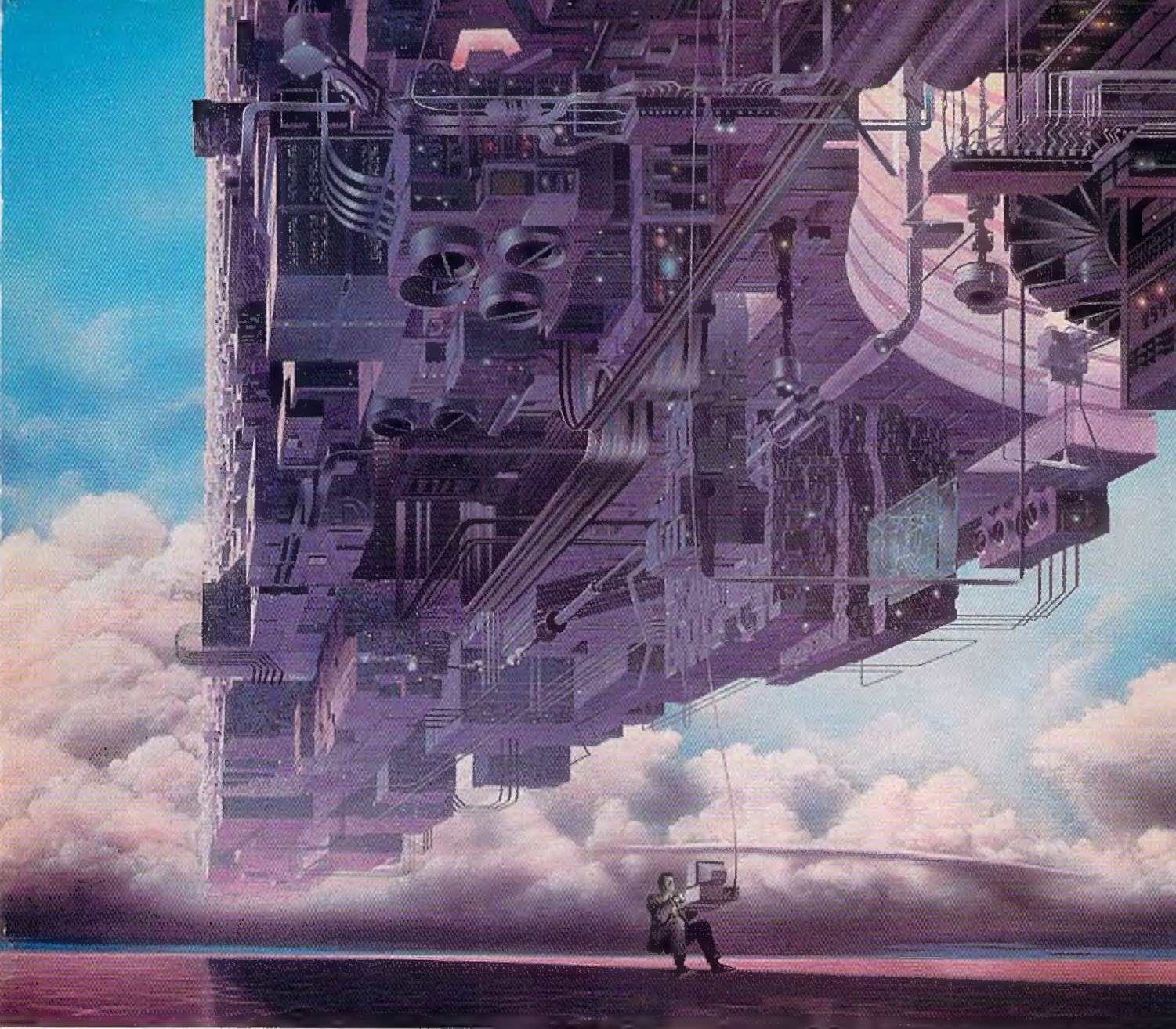
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*=General, 64=Commodore 64, +4=Plus/4, 16=Commodore 16, 128=Commodore 128

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editor's notes

Last month in this column, we thanked those readers who responded to the "Gazette Readership Survey" in the December 1987 issue. The last few returns have trickled in, and we've tabulated the results. We're pleasantly surprised by the number of respondents, nearly 1300. This month, we'd like to share with you some of the more interesting results.

In machine ownership, 74 percent have 64s, 38 percent have 128s, and 6 percent have Plus/4s or 16s. Quick addition shows that there are several homes with more than one Commodore model. More than 70 percent of the respondents have no plans to buy another computer in the coming year. Of those who do, here's the breakdown: Commodore 128, 35 percent; Amiga, 33 percent; IBM PC/compatible, 19 percent; and the rest are divided among Commodore 64, Apple II, Atari ST, and Radio Shack. Adding the numbers for 128, 64, and Amiga reinforces what's been said for years: Commodore owners have tremendous brand loyalty.

Nearly half of the respondents use GEOS, while, surprisingly, only 28 percent are members of a Commodore user group. In peripheral ownership, 88 percent own dot-matrix printers, 23 percent own letter-quality printers, 45 percent own modems, and 12 percent have memory expansion. Word processors and games were the most common software purchases in the past year. Nearly 9 out of 10 readers program their computer, and the most preferred languages are clearly BASIC (72 percent) and machine language (20 percent). The Programming section of the magazine is the most widely read, and, accordingly, "Hints & Tips," "Simple Answers to Common Questions," and "Readers' Feedback" are the favorite columns. More than 90 percent use the programs in GAZETTE.

There's a correlation between the survey results and our reader mail. What they tell us is that the typical GAZETTE reader is not a passive user, but one who is active and, in varying degrees, one who spends time programming.

As active Commodore users and programmers ourselves, we often wonder, as we're sure you do, about the future of the 64 and 128 in an industry that seems to spin as wildly as a whirling dervish. Our features editor, Keith Ferrell, asked Commodore's Rich McIntyre, as well as some software publishing leaders, about how these machines will measure up in the hi-tech future. The results are in our cover story (p. 12). It's a must-read.

Lance Elko

Lance Elko
Senior Editor

COMPUTE!'s GAZETTE

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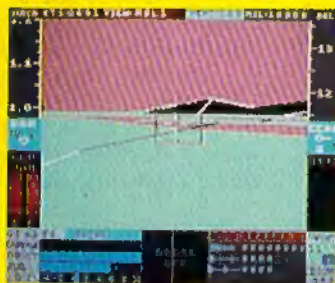
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letters to the editor

Oops!

In the review of the Commodore 1581 disk drive (March issue), it was incorrectly stated that there are no disk copy programs available that will copy the entire contents of a 1541 or 1571 disk to a 1581 disk, or vice versa. Super 81 Utilities from Free Spirit Software does just this, and then some. We regret the oversight. Details on Super 81 Utilities may be found in Free Spirit's advertisement on page 95 in this issue.

Fastest Yet

With "Final BASIC" (February) installed on my 128, the computer runs much better. It now executes nothing with blinding speed! Thank you.

Gilbert Canales
Salinas, CA

Yes, we enjoy this program very much, too. In fact, each morning here at the office, we load Final BASIC, type the BEETHOVEN command, and pretend we're listening to the Fifth Symphony throughout the day.

No More Slip

Here's an idea that costs almost nothing to try and makes your keyboard stay in place on a slippery desktop. Cut a piece of cardboard just a little larger than the keyboard. On one side of the cardboard, glue four pieces of rubber band (the half-inch variety found in most kitchens) that have been cut once and placed flat side down on the cardboard. After the glue has dried, flip the cardboard over and place your keyboard on it. Presto! Now it stays in one place.

R. G. Borkenhagen
Lynnwood, WA

Switcheroo

In your January and February issues, many of your advertisers offered attractive prices on the Commodore 2002 monitor. In your February issue, you ran a review by Clifton Karnes, describing it as recently released. In mid-December, I phoned several of your

advertisers, attempting to order the 2002, and all told me that Commodore had discontinued it. They had a much more expensive monitor, which was said to be a replacement for the 2002. I realize that magazines go to press long before they are mailed. When is the February issue actually printed?

Jean P. Nance
St. Joseph, IL

I was a bit surprised by your review of the Commodore 2002 monitor. I had had one for about three months when it went belly-up. The Commodore dealer I bought it from said he could not get parts for it and swapped it for a 1084 monitor. The 1084 is not as pretty, but I like it better—it seems much clearer and brighter than the 2002.

Carol L. Hazlett
Issaquah, WA

Mr. Karnes responds: I was as surprised as our readers to learn that the 2002 had been replaced by the nearly identical 1084. We make every effort to be as up-to-date as possible, but each issue is prepared for publication about three months before you see it. In late October, when the review was written, the 2002 was unquestionably Commodore's flagship monitor, and there was no reason to expect this to change in the near future. Commodore officially discontinued the 2002 (but was shipping them as late as January of this year). As far as the quality of the 2002 is concerned, we have several here at the office, and have experienced no problems. Incidentally, at this writing, the price of the 1084 from various dealers and wholesalers is about the same or slightly higher (\$20-\$30) than the fall price of the 2002.

Camping Computerists

Here's an answer to the person who wants to use a computer in his travel trailer ("Simple Answers To Common Questions," February). Use your portable generator or outside AC power through a 110-to-12-volt converter to charge the trailer's auxiliary battery, and use a 12 volt-to-110 frequency-controlled inverter with enough power capacity for the computer, disk drive,

monitor, and printer. The reason for not using the computer equipment directly off the outside 110-volt AC is because of the extreme voltage fluctuations that are usually encountered at campgrounds.

Joseph Frappier
Vienna, VA

The real problem for traveling computerists was not asked about or addressed by you, and that is protection of media. I've had several files corrupted on my disks as a result of placing them near power wiring concealed in walls, or leaving them near windows which were shaded when we went out for several hours, but were not when we came back because of the position relative to the sun. You might caution traveling readers to be sure to store their disks or tapes of any type (video or computer) in a locker where heat, electric or magnetic fields, and/or sunlight can't get them.

William P. Brown
Fallbrook, CA

Undocumented Feature

"Gradebook" (October 1985 and the 1988 Special Issue) claims that all grades must be less than or equal to the perfect mark for an assignment—that is, extra credit cannot give a student a better-than-perfect score. Such grades are rejected as invalid. To get around this, enter a perfect mark higher than the best grade, enter grades, then change the perfect mark to its real value. Better-than-perfect scores are still indicated as errors when highlighted, but are used as entered in computing averages and grades.

Pat Connolly
Middletown, RI



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Networking The Commodore 64

Thomas Netsel, Assistant Features Editor

Networking is becoming big business in schools. Computer labs, or classrooms with several computers, are reaping benefits from linking the computers together under the control of the teacher's machine. The attractions of such a system are obvious: reduced file-loading time, enhanced monitoring ability for the teacher, increased security for storing data.

The RTC Multi-Link Networking System allows as many as forty-eight 64s, 128s, or PETs to be linked together with the teacher's computer serving as a central storage device and file server. Networking boards and cables plug into the computers' cartridge ports. RTC Multi-Link is unique in that it comes with a 20-megabyte ICT Mini Chief hard drive. Designed to make the system especially useful in computer labs, Multi-Link lets each terminal in the network access its hard drive for loading or saving files. Terminals can work together on the same program, or they can operate independently. This permits the teacher to tailor the system to fit his or her teaching requirements. While a majority of students in a class will typically use the same program, students with special needs can work on other programs, if the teacher wishes. RTC Multi-Link handles all the traffic among the terminals, the hard drive, and as many



as four different printers at a time.

Faster Loading

Terminals can load programs from the hard drive or a floppy drive. Software can be loaded into the Multi-Link, and then sent to a specific terminal or range of terminals. This feature saves a substantial amount of time in a class where a number of computers have to be booted from a limited number of disks.

"A typical problem with the 64 is the time it takes to load and operate," says Charles Thompson, vice president of sales and marketing at RTC Multi-Link. "We've incorporated a RECORD/PLAY function that speeds up the loading process. A teacher can load ten 64s in the time it takes to load one on a local basis. This is achieved through a memory transfer."

The RECORD function treats the teacher's computer somewhat like a tape recorder. After the teacher loads a program, the PLAY function sends the program to the desired terminals. This lets the students' terminals load from the teacher's, completely bypassing the individual 64 drives.

"The result is that a program that would normally take about 90 seconds to load from the 1541 drive will now load in about 12 seconds per terminal computer," Thompson says.

For years, businesses have realized the advantages of linking PCs into a network. Offices boost efficiency by sharing common files and programs, and enjoy the convenience of being able to send messages to other computers on the system. Now schools that use Commodores in their computer labs can have the features and flexibility of a network, with files served from a 20-megabyte hard drive.

Monitoring Commands

From the central unit, a teacher can monitor and control any of the terminals on the network. If a student has a problem with a program, the teacher can call up a student's screen and offer input or assistance.

This can be done without the teacher or students leaving their desks, or even speaking out loud, since the Multi-Link system supports bidirectional window messaging. Messages can be sent from any terminal on the network to any or all of the other terminals. The teacher's computer controls this feature. When the teacher sets up the program, he or she has the option of allowing messages to be sent from terminal to terminal or from terminals to the teacher. Messages appear in a window on a terminal's screen, remaining there until any key is pressed.

When setting up the system, the teacher has the option of implementing other features or restrictions. It is conceivable that a terminal can tie up the network for several minutes with a series of drive, printer, or message commands. The teacher can prevent this from happening. The teacher can also determine the number of times an individual terminal may access the network bus before it is automatically halted. The system can also be configured to prevent students from renaming or scratching files, or from formatting the disk.

Password Protection

The teacher establishes the amount of security the system should have. While any terminal can use a floppy drive connected to it, passwords can be used to restrict access to the hard drive or printers. Once the

teacher types *passwords*, their use becomes mandatory before any terminal can access the system. Passwords must be on file in the central unit's memory. A student may use any terminal on the system, but any attempt to log on without the proper password results in a *not allowed* error. Another password locks the central keyboard if the teacher has to leave the room unsupervised while the network is active.

Extra Commands

In addition to BASIC 2.0, the RTC Multi-Link Networking System provides 21 extra commands. Most commands are followed by a specific terminal number or range of consecutive terminals. Appending the word ALL to the command sends that command to every computer on the network. The teacher can easily determine which terminals are online if a command is sent to a terminal that is not on the network.

The ECHO command causes anything typed on the teacher's keyboard to appear on the screens of selected terminals. BREAK followed by a number or range of numbers is the equivalent of pressing the RUN/STOP key on those terminals' keyboards. BREAK returns the terminal to the READY prompt. The HALT command is similar, but it simply freezes the terminal's screen and prevents it from responding to its keyboard until the teacher issues the CONTINUE command.

Other commands include DISALLOW, which prevents specified terminals from using the printer or hard drive; QUERY, which prevents terminals from executing either printer or drive commands until they receive permission from the teacher; and SCREEN, a command that du-

plicates students' screens, letting the teacher monitor classwork.

Classroom Tested

The Canadian designers tried to include features to make the system as flexible as possible, but they also wanted the teacher to maintain complete control of the network at all times. According to Thompson, when the system was 80-90 percent complete, officials at Commodore-Canada's educational department suggested it be placed in a school for testing. After using the network in a classroom environment, the computer teacher offered several suggestions and improvements that were incorporated into the system's final design.

The software and hardware for a ten-terminal system, including the 20-megabyte hard drive, costs \$2640. Schools working with a smaller budget can set up a similar network without the hard disk drive for \$1640. Additional terminals may be added at a cost of approximately \$175 each, Thompson says.

Operating a computer lab on a network may be a new experience for some teachers, and RTC Multi-Link is aware that schools may like to know more about such a system before buying it. "Since some teachers are not fully comfortable teaching in a network environment," Thompson says, "we are allowing schools to try the system on a 30-day basis. Basically, if it doesn't live up to their expectations, or they don't like teaching in a network environment, there's no cost." For information, write RTC Multi-Link, 110 Riviera Dr., Unit 10, Unionville, Ontario, Canada L3R 5M1; or call 1-800-387-4221 in the U.S. or 416-479-6220 in Canada. ■

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The Future Of The 64 & 128

Industry Leaders' Forecasts

Keith Ferrell, Features Editor

Five years after the introduction of the 64, Commodore's eight-bit superstar is still going strong. The continued strength of the 64—and the 128—have caught more than a few industry observers off guard, prompting repeated postponements of the machines' obituary notices. Many other computer manufacturers would be delighted to have sales figures for new machines that could match those of Commodore's long-lived duo.

Recently, *Gazette* talked with Rich McIntyre, Commodore's Senior Vice President in charge of Sales and Marketing. We wanted to know what Commodore sees as the future of its two best-known machines. While McIntyre is perhaps the world's preeminent Commodore salesman, he's also a shrewd and canny observer of the microcomputer industry, making points that are telling about the industry's tendency to embrace advancement for the sake of advancement.

In addition, we gathered opinions from some software industry leaders, getting their perspectives on the place the 64 and 128 will occupy in the next few years.

Gazette: *Despite all the rumors and predictions, the 64 is still going strong. Has that surprised people?*

McIntyre: The accounts of its death are greatly exaggerated, that's for sure. We'll sell over a million eight-bit 64 and 128 units this year.

Gazette: *How many 64s and 128s have been sold by now?*

McIntyre: Over seven million.

Gazette: *Is that the largest installed base for a single family of machines?*

McIntyre: I don't think anybody's passed it yet—in units. In dollars, of course, it's been passed. But in units, I think we rank way up there.

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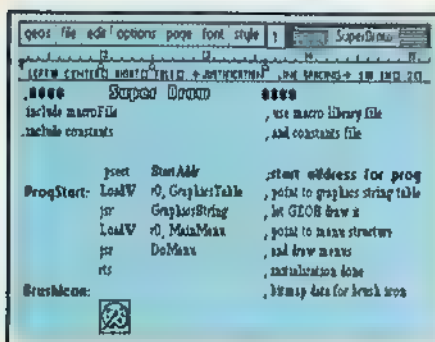
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Gazette: One of the keys to Commodore's success is the terrific brand identification consumers have with the company name as well as its products.

McIntyre: This is a tremendous resource that Commodore has. Especially members of Commodore user groups—they're just devout.

Gazette: Many of those users love the machine's game capability. Since gaming is one of the 64's strengths, the renewed strength of the video-game cartridge industry has put some pressure on Commodore. One of the keys to Nintendo's success seems to be its aggressive TV marketing campaign. Last winter you experimented with renewed TV advertising for the 64. Your commercials positioned the 64 as a great game machine—and much more. Did that pay off?

McIntyre: Yes, it did. We targeted the machine toward the potential customer. The customer for that product, we felt, was around 12 years old. We positioned the machine as, while a computer, also a very dynamic and rich entertainment system. The number of games that are available for the 64 outnumber those for Nintendo and Sega. There are still new games being released.

Gazette: For the parents of youngsters in that target market, you touted the advantages of giving the children something more than just a game machine.

McIntyre: The print ads that we ran in that December period targeted toward the parents, ran directly against the message we were trying to get to the children. To the parents we were saying that the 64 could do more than play games.

Recreation is certainly one of the major reasons to buy a system. Entertainment will always be a key element in 64 and 128 strategy. But, we asked the parents to consider the value of the investment and the fact that the computer can provide many, many more functions than just recreation.

It's an educational tool, a productivity tool, as well as a learning device. We felt that the computer versus the game machine had many more advantages that would far and away compensate for the price difference between a 64 and a [cartridge] game machine.

The Golden Age Of 64 Software

Robert Jacob of Cinemaware views the present as the beginning of a renaissance in 64 software design.

"The golden age of Commodore software got started just a few months ago," Jacob states.

What's causing the renewed strength?

"Several factors. Part of it is directly attributable to *Deluxe Paint* on the Amiga. All of our graphics are done on the Amiga and ported down to the 64. It's more powerful than any drawing package available.

"Second, the inclusion of fast loaders by the major software publishers dramatically speeds up disk I/O on the 64. With a fast loader such as V-Max, we can load as much as 20 times faster than normal Commodore DOS," Jacob points out.

"We no longer rely on character sets," he says. "Bitmapped graphics give you bigger, more powerful games.

"Music is also a factor. The English are ahead of us in terms of music drivers. Few people have fully tapped the abilities of the SID chip yet."

All of which produces a renaissance.

"Yes. Much better sounding games, faster disk access, better graphics—you can see why I'm so excited.

"I am very bullish on the Commodore market."



Gazette: And that strategy paid off for Commodore as well?

McIntyre: Yes, it did. We included a free software offer and received tens of thousands of coupons, every one of them representing a purchase.

Gazette: There are a variety of games that we'll never see on a cartridge machine.

McIntyre: Exactly. The fact that the game is on a disk gives you more latitude as to the type of game you can play.

Gazette: How else do you go about responding to Nintendo?

McIntyre: Quite frankly, if someone came up to me and said, "I've got a Nintendo and I'm playing X on it," I'd say, "That's great, I can play it on my 64. Can you do this? Oh, sorry, you can't even type anything in, can you? I can save my

scores on the disk drive. Can you do that on a Nintendo cartridge? I can play my games online, can you?"

The games that are being ported to the Nintendo are, for the most part, Commodore 64 games. They are going right after the 64 titles.

Gazette: What about rumors of a 16-bit Nintendo?

McIntyre: Bring it on! A 16-bit game machine, whether Nintendo, SEGA, NEC, or whatever else, will be a game machine that costs exactly as much, if not more, than a 64. My goodness, I can't wait.

Gazette: Is your primary outlet still the general retailer?

McIntyre: It is still the mass merchant. The largest percentage of our business goes through the Sears-, the Toys "R" Us-type channel, because of the price point.

History Repeats Itself!

In 1977 Avalon Hill introduced the board game *Iron Men* to the table top gaming public. Eleven years later, Avalon Hill introduced to your pleasure the microcomputer game

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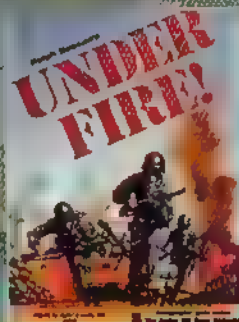
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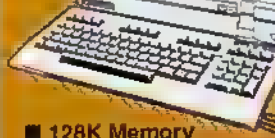


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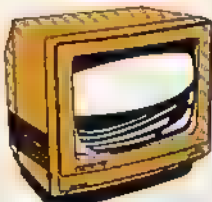
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Gazette: How does Commodore maintain a successful mass-retailer presence when many larger computer companies cannot?

McIntyre: Product recognition is high, obviously. It's been on the market for five years now. That channel is very important to us.

The support that we're still receiving from third parties allows that to be. There are still new titles being written for the Commodore 64.

Gazette: Those developers are continuing to stretch the limits of the machine.

"We cannot keep up with demand on the 128."

McIntyre: Programmers are still learning about the 64, still finding things they can take advantage of when they're writing software.

As far as high quality, low-cost graphics machines, the Commodore 64 was the first, and is still an excellent device to be used in that area. It does have limitations, in terms of memory and speed. But, for the price performance, it's still the best deal.

Gazette: What about the 128-specific market? Are you seeing any increases in 128-only software?

McIntyre: In 128-specific software, really, in the productivity aspects, all you're going to be seeing is 80-column software. There's no recreational software *per se* written for the 128.

In productivity, though, there's GEOS128. Time-works has a large 128 installed base.

Gazette: Does the machine continue to sell?

McIntyre: The 128 is a product that Commodore can't keep in stock right now. That product is still selling very well. We cannot keep up with demand on the 128D.

Gazette: Will we see, then, this success broaden? Is there going to be a Commodore 256?

McIntyre: No. We have a RAM Expander, the 1764. And of course we have the 1700 series, the 1700 and the 1750 RAM Expanders for the 128. That's how we will address memory expansion for these products.

We're the world's largest purchaser of DRAMs [Dynamic RAMs], and we have been severely impacted by the price increases. So to build an eight-bit machine today with more resident on-board memory would increase the cost of it.

For those who wish to utilize bank switching and increased memory, they're available to them with the 1764 RAM Expander.

Gazette: What about a Commodore hard disk drive?

McIntyre: You will not see it for the 64.

The 64 In A Squeeze: The View From Activision

Bruce Davis, president of Activision, takes a different view of the 64's future, a view somewhat less sanguine than Rich McIntyre's.

"The 64 is taking a lot of heat from Nintendo. Tandy is doing a good job of lowering prices and upping the performance of its MS-DOS machines. And the 64 is getting squeezed," Davis says.

How does Commodore succeed in such a market?

"First, they need to improve the price-value relationship. The 64 has been selling at the same price with the same basic features for quite a few years now. Commodore needs to either lower the price or add more features. Something's got to change, or they'll continue to lose market share."

How does the 64 look from the software perspective?

"Again, market share has gone down. We've also seen some price degradation on 64 software—the only format where price degradation has occurred.

"This creates problems for the publishers. The average selling price for a Nintendo cartridge is higher than for a 64—this is not a plus for us."

Doesn't Commodore's large base of machines offset lower prices?

"A top-selling videogame title easily sells in six figures," Davis notes. "It's rare for a 64 title to get six figures. So the argument that a huge installed base justifies lower margins is not true anymore."

How long, then, can you continue to support the 64?

"Several more years. There are still decent profit opportunities. Obviously there are some changes in product strategy. Where the majority of revenues two years ago came from the 64, it now accounts for less than a third."



Gazette: Users can get hard drives from third-party manufacturers such as Xetec.

McIntyre: Yes, we don't have to reinvent the wheel. If there is a specialized market for hard drives, and a third party wants to take advantage of it, we encourage it.

Gazette: Doesn't the level of interest in hard drives and so on indicate that there are 64s and 128s being used in increasingly sophisticated ways?

McIntyre: Look at Berkeley Softworks. They're running laser printers off of 64s. Berkeley has really shown

the world the productivity aspects of the machine. I was here during the launch of this product. I am very much a fan of it, and I am still not convinced that it has reached its full potential.

Sometimes when people come into my office, I'll take a letter off my desk and ask them whether the letter was done on a Commodore 64 or not. How can you tell? The quality of the output is directly related to the quality of the output device. The processor is limited only by the quality of the output device. If you run a laser printer with a 64, you cannot tell the difference.

If you can put an eight-bit machine into an environment and be satisfied with its performance, recognizing that it does have certain limitations, and you're willing to live with those limitations, you will have a very powerful microcomputer.

"If someone launched a machine today that was going to sell a million units in the next calendar year, would the developers support it? There would be a stampede."

Gazette: Let's talk about a couple of those environments. Commodore has rededicated itself to the education market. Will we be seeing more 64s and 128s in schools?

McIntyre: The 64 is in front of more students, for a smaller amount of money, than any other microcomputer. That's how we position it in the education market.

After all, the purpose of the exercise is to get as many students as possible exposed to microcomputer technology. We're not trying to expose them to 386 technology; we're trying to expose them to computer technology. With budgets as they are today in education, the 64 represents a tremendous opportunity. You can put more 64s in front of more students than any other machine in your budget.

Gazette: Are you seeing a strong educational response to your new marketing initiative?

McIntyre: We have gone back into the field to establish educational dealers, and the response has been tremendous. The 64 is still selling into the elementary levels. It's not selling anywhere near the levels it once did, but you have to put that into perspective. There are today a lot more microcomputer systems available than there were when the 64 was launched.

The 64 still has about a 20-percent share in the educational market, in terms of installed base. According to Market Data Retrieval, there are [in 1986-87] 130,908 Commodore units installed in public schools. That is a substantial piece of the business—as opposed to 68,000 IBMs, about twice as many.

Gazette: Another environment is business. Are you still finding 64s in that environment?

McIntyre: Yes. For those who are aware enough of computer technology to not feel that they need a mini-computer to accomplish their purposes, there's the 64.

Cable stations still use 64s as character generators. That's a cost savings! We're talking \$20,000 for a character generator, as opposed to the cost of a 64.

Gazette: You're coming off a successful year with the 64. How many more such years lie ahead? How long can the machine continue to sell? Already, some publishers are concerned about a declining share of the market for 64 software.

McIntyre: Software base and third-party support are the critical factors.

Sometimes I listen to software developers, and I get a little angry. I want to ask them, "Why are you trying to kill this product? Is there not a large enough installed base to support your efforts?"

The sales versus two years ago aren't as great. So? If someone launched a machine today that was going to sell a million units in the next calendar year, would the developers support it? There would be a stampede.

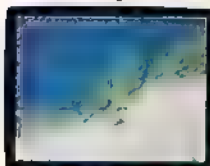
Gazette: MS-DOS dominates the software market in terms of percentage of sales, but the unit sales of 64 software continue to increase. Are there still opportunities for software developers in the 64/128 market?

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BY EPYX

Commodore 64/128, Apple II & compatibles, IBM & compatibles
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Sir-Tech Sees The Future

Robert Sirotek, vice president of Sir-Tech software, thinks Commodore and its eight-bit machine are up to the challenges facing them.

"There's a heck of an installed base, so, from the software level, its future continues to be very optimistic," Sirotek says. "That's why we're supporting the machines with many titles."

What about the hardware itself? How long can Commodore continue selling 64s and 128s?

"As far as the hardware side, Nintendo and Sega are nipping at Commodore's heels. Commodore has a real positioning problem, having to react by updating the 64's hardware in some manner or repositioning it to compete head-on with Nintendo."

Can it be done?

"I have complete confidence that Commodore will pull it off. They won't go away."



McIntyre: Berkeley Softworks, again, is a good example. This is a company that started out two years ago to support a product that at the time was three years old. Brian Dougherty [Berkeley's founder] feels that we haven't exploited the 64's capabilities yet—and he keeps showing us that.

Gazette: At the same time, Commodore has expanded its presence with the Amiga and with your PC compatible. Do these ventures take energy away from the eight-bit products?

McIntyre: We are not going to walk away from that part of the business. The 64 and the 128 have been and will continue to be an important part of Commodore Business Machines, no matter what we do with Amiga technology, with MS-DOS technology. None of it is done to the exclusion of our core business.

Now, we have a problem, too. As soon as something reaches its peak in this country or levels off a bit or—worse than that—declines somewhat, we have a tendency to walk away from it. That's crazy!

Gazette: But that's business.

McIntyre: I have this discussion with merchants all the time: "Well, sales aren't what they were this time last year."

"How are your profits? How is the return on retail space?"

If today we made a sales presentation on a product that would return what the 64 returns, the merchant would take it on. You have to keep things in their proper perspective.

Gazette: In terms of marketing, what other advantages has the 64 acquired over its history?

McIntyre: The functionality of the machine has also grown. QuantumLink is a good example. Here's an online service available to the 64 user. For about \$350—computer, disk drive, modem—you've got online shopping, banking, airline reservations, information services, and so on.

Gazette: Despite this, the machines sometimes get rapped as being old-fashioned, obsolete.

McIntyre: Today, if we positioned the 64 in the marketplace—forget RAM, bytes, bits—if we went out and functionally described the Commodore 64, it would be heralded as a fantastic advancement in personal micro-computing.

The problem is that if you start to talk to people who have been in this business since its inception, they start to get jaded: "It's only eight-bit."

Who cares? You are buying this machine for a specific reason. If it satisfies that need, it is never obsolete. Only your requirements become obsolete. If you no longer require it, then you obviously would no longer need hardware to satisfy the need. The need ceases to exist—not the hardware. If the need continues to exist until the year 2000, then that machine is still satisfactory.

There is no such thing as hardware obsolescence. That is a phrase that was coined by the naysayers in this industry. That's baloney.

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A Guide To Commodore User Groups

Part 1

Mickey McLean

This annual GAZETTE feature provides an up-to-date list of user groups across the U.S., throughout Canada, and around the world. Part 1 includes states A through M (Alabama-Montana). Under each state heading, groups are sorted in order according to zip code.

User groups from the remaining states (Nebraska-Wyoming) and from outside the U.S. (including APO addresses) will be listed in Part 2 next month.

ALABAMA

Valley Commodore Users Group (VCUG), P.O. Box 835, Decatur, AL 35602 0835
 Scottsboro Commodore Users Group, Rt. 5 Box 255, Scottsboro, AL 35768
 Sequoyah Users Group (SUG), 702 Williams Ave N., Ft. Payne, AL 35967-2624
 Montgomery Area Commodore Computer Society (MACKS), P.O. Box 210126, Montgomery, AL 36121-0126
 East Alabama Users' Group, P.O. Box 249, Jacksonville, AL 36265
 The Byte Bunch, P.O. Box 185, Evergreen, AL 36401
 Amiga/Commodore Club of Mobile, 3868 H Rue Maison Mobile, AL 36608
 Commodore Mobile Users Group (CMUG), P.O. Box 9524, Mobile, AL 36691 0524
 The Lighthouse BBS User Group, Rt. 2 Box 196, Salem, AL 36874
 Smiths Alabama Commodore User Group, Rt. 2 Box 105, Smiths, AL 36877

ALASKA

Anchorage Commodore Users, P.O. Box 104615, Anchorage, AK 99510 4615
 Sitka Commodore User's Group, P.O. Box 2204, Sitka, AK 99835
 First City Users Group, Box 6002, Ketchikan, AK 99901

ARIZONA

Commodore User Group of Arizona, P.O. Box 21291, Phoenix, AZ 85036
 Arizona Commodore Users Group, P.O. Box 27201, Tempe, AZ 85282
 Gila Hackers, Rt. 1 Box 34, Globe, AZ 85501
 C64/128 Information Exchange Group, 1345 S. Kolb Rd #345, Tucson, AZ 85710
 Catalina Commodore Computer Club Inc., P.O. Box 32548, Tucson, AZ 85751

ARKANSAS

The Southwest Arkansas Commodore Users Group, 404 S. Greening St., Hope, AR 71801
 Commodore User Group, Rt. 9 Box 354-A, Hot Springs, AR 71913
 Commodore Information Association (CIA), Rt. 1 Box 103-F, Mayflower, AR 72106
 River City Commodore Club, P.O. Box 4298, N. Little Rock, AR 72116
 The Commodore Council, 1821 Breckenridge Dr., Little Rock, AR 72207
 The S.T.O.N.E. 64 Users Group, P.O. Box 301, Reyno, AR 72462

The Personal Touch Commodore User Group of Hoxie and Walnut Ridge, 503 Kaylynn Dr., Walnut Ridge, AR 72476
 Harrison Users Group, Rt. 1 Box 15, Harrison, AR 72601

CALIFORNIA

Hollywood Users Group (HUG) for Commodore Computer Owners, P.O. Box 38313 Hollywood, CA 90038
 South Bay Commodore Users Group (SBCUG) (suburban L.A.), P.O. Box 1176, Redondo Beach, CA 90278 0176
 C128 West Commodore 128 User Group, 2917 Colorado Ave., Santa Monica, CA 90404
 Commodore 64 West Users Club (West L.A. and Santa Monica), P.O. Box 406, Santa Monica, CA 90406-0406
 Begabytes C64, 9802 S. Calmada Ave., Whittier, CA 90605
 West Orange County Commodore Users Group, P.O. Box 6441, Buena Park, CA 90622
 Southern California Commodore Users Group, 11018 E. Rosencrans Ave., Suite 203, Norwalk, CA 90660
 Commodore Helpers of Long Beach, 3736 Myrtle Ave., Long Beach, CA 90807
 San Fernando Valley Commodore Users Group, 7017 Geyser Ave., Reseda, CA 91335
 California Area Commodore Terminal User Society (CACTUS), P.O. Box 1277, Alta Loma, CA 91701
 Rosemead Associated Members (RAM), 2636 Willard Ave., Rosemead, CA 91770
 South Bay Commodore Users Group, P.O. Box 1899, Chula Vista, CA 92012-1899
 Oceana-64 Commodore User Group, 1004 Plover Way, Oceanside, CA 92056
 Back-Country Commodore Club, P.O. Box 776, Ramona, CA 92065-0776
 Armed Forces Commodore, 4631 Gainard Way, San Diego, CA 92124
 San Diego Commodore Users Group, P.O. Box 86531, San Diego, CA 92138
 General Dynamics CRA Commodore Computer Club, General Dynamics Electronics, MZ-7234A, P.O. Box 85310, San Diego, CA 92138-5310
 Hi Desert Commodore Users Group, 62026 Sunburst Cr., Joshua Tree, CA 92252
 Club-64 (San Bernardino), P.O. Box 514, Patton, CA 92369
 Commodore Users Group of Riverside (CUGR), P.O. Box 8085, Riverside, CA 92515
 Power Surge, c/o Orangewood Academy, 13732 Canyon Ave., Garden Grove, CA 92643

West Orange County Commodore User Group, 20311 Ravenwood Ln., Huntington Beach, CA 92646
 South Orange Commodore Klub (SOCK), 25401 Champlain Rd., Laguna Hills, CA 92653
 Southern Orange County Commodore Computer Services Group (SOCCCS), The Wizard's Exchange, 24212 Hollyoak Ln. Apt. D, Laguna Hills, CA 92656
 Commodore Technical User Group (CTUG), P.O. Box 8342, Orange, CA 92664
 Ventura Commodore Club 1306 Finch Ave., Ventura, CA 93003
 CIVIC64, P.O. Box 2442, Oxnard, CA 93034-2442
 A Bakersfield Area Commodore Users Society (ABACUS), 3101 Oakridge Dr., Bakersfield, CA 93306
 San Luis Obispo Commodore Computer Club, P.O. Box 3836, San Luis Obispo, CA 93403-3836
 Simply Users of Computers Combining Experience for Strength and Success, 184 Santa Ynez Ave., Paso Robles, CA 93446
 Central Coast Commodore Users Group, 4237 Plumeria Ct., Santa Maria, CA 93455
 Antelope Valley Commodore User Group (AVCUG), P.O. Box 4436, Lancaster, CA 93539
 Madera Users Group (MUG), P.O. Box 783, Madera, CA 93639
 Valley Commodore Users Group, P.O. Box 3228, Salinas, CA 93912
 PLUG (Plus/4 Users' Group), Box 1001, Monterey, CA 93942
 Monterey Peninsula Commodore Group, P.O. Box 2105, Seaside, CA 93955
 Ft. Ord Commodore Users (FOCUS), P.O. Box 2180, Seaside, CA 93955-2180
 CWest Bay Area Commodore Users, 850 Burnett #11, San Francisco, CA 94131
 PET-On-The-Air, 525 Crestlake Dr., San Francisco, CA 94132
 Diablo Valley Commodore User Group, P.O. Box 27155, Concord, CA 94527
 Marlin Commodore Computer Club, 665 Las Colindas Rd., San Rafael, CA 94903
 64/More Commodore User Group, Inc., P.O. Box 26811, San Jose, CA 95159-6811
 Stockton Commodore Users' Group, P.O. Box 8354, Stockton, CA 95208
 Lake County Computer Users Commodore SIG, P.O. Box 385, Clerlake, CA 95422
 Amateurs and Artesians Computing, P.O. Box 682, c/o Alex KR6G, Cobb Mountain, CA 95426
 Computer Users Group of Ukiah (CUGU), c/o Wood Enterprises, 1107 S. State St., Ukiah, CA 95482
 Auburn Commodore Computer Club, P.O. Box 4270, Auburn, CA 95604
 Fairfield Commodore User's Group, 366 Royal Oaks Dr., Vacaville, CA 95688
 Sacramento Commodore Computer Club, P.O. Box 13393, Sacramento, CA 95813-3393
 North Valley Commodore Users Group (NVCUG), P.O. Box 7658, Chico, CA 95927
 Commodore Owners Users Group of Redding (COUGOR), 37 Rose Ln., Redding, CA 96003

COLORADO

Colorado Commodore Computer Club, 11855 Adams St., Northglenn, CO 80233
 Ft. Collins C3, P.O. Box 2051, Ft. Collins, CO 80522
 Front Range Commodore Club, P.O. Box 272, Niwot, CO 80544-0272
 Commodore Club, P.O. Box 25851, Colorado Springs, CO 80936
 The Local Folks Computer Club, 1653-130 Rd., Glenwood Springs, CO 81601

CONNECTICUT

Capital Region Commodore Computer Club (CRCCC), P.O. Box 2372, Vernon, CT 06066
 Hartford County Commodore Users Group, Inc., P.O. Box 8553, East Hartford, CT 06108
 Eastern Conn Commodore Users Group, 227 Jagger Ln., Hebron, CT 06248 (BBS# 203-228-1031)
 Computer Users Group, 6 Saner Rd., Marlborough, CT 06447
 Commodore Users Group of Stratford, P.O. Box 1213, Stratford, CT 06497
 The Naugatuck Valley Commodore Users Group, P.O. Box 622, Waterbury, CT 06720

South Kent Users Group (SKUG), Box 97, South Kent, CT 06785
 Fairfield County Commodore User Group (FCCUG), P.O. Box 212, Danbury, CT 06813
 Stamford Area Commodore Society (SACS), P.O. Box 2122, Stamford CT 06906 0122

DELAWARE

Special Interest Groups NLLI (S*G*NLLI), 2438 Owen Dr., Wilmington, DE 19808
 First State Commodore Club, P.O. Box 1313, Dover, DE 19903
 Lower Delaware Commodore Computer Club (LDCCC), P.O. Box 5344, Nassau, DE 19969

FLORIDA

Port Orange Commodore User Group (POCUG), 1244 Thomasina Dr., Port Orange, FL 32019
 Public Domain Users Group, P.O. Box 1442, Orange Park, FL 32067
 Welaka Commodore Users Group, P.O. Box 1104, Welaka, FL 32093-1104
 Commodore Computer Club of Jacksonville, 8438 Lyndia Sue Lane W., Jacksonville, FL 32217
 Bay Commodore Users Group (BCUG), P.O. Box 3187, Panama City, FL 32401
 Fort Walton Beach Commodore Users Group, P.O. Box 3, Shalimar, FL 32579
 Gainesville Commodore User Group, P.O. Box 14716, Gainesville, FL 32604-4716
 Citrus Commodore Computer Club, P.O. Box 503, Beverly Hills, FL 32665
 Lake/Sumter Commodore Users Group, P.O. Box 416, Leesburg, FL 32749
 Lake County Educational Users Commodore Club, P.O. Box 326, Tavares, FL 32778
 Titusville Commodore Club, 890 Alford St., Titusville, FL 32796
 Central Florida Commodore Users Club, P.O. Box 547326, Orlando, FL 32854-7326
 El Shift OH, P.O. Box 361348, Melbourne, FL 32936-1348
 Fellsme's Club Compu-Mania Inc., P.O. Box 629, Fellsme, FL 32948-0629
 Miami Individuals with Commodore Equipment (MICE), 11110 Bird Rd., Miami, FL 33165
 Miami 2064 Commodore Users Group, 11531 SW 84 St., Miami, FL 33173
 Gold Coast Commodore Group, P.O. Box 375, Deerfield Beach, FL 33443
 Starcom User's Group of Martin County, P.O. Box 1446, Port Salerno, FL 33492
 Charlotte County Commodore Club (CCCC), P.O. Box 512103, Punta Gorda, FL 33951-2103
 Bits and Bytes Computer Club, 1859 Neptune Dr., Englewood, FL 34223
 Commodore Brooksville User Group (C-BUG), P.O. Box 1261, Brooksville, FL 34605
 Clearwater Commodore Club Inc., P.O. Box 11211, Clearwater, FL 34616
 R.H.C.C. Users Group 64/128, 8032 Banister Ln., Port Richey, FL 34668
 Suncoast Bytes Commodore Computer Club, P.O. Box 721, Ellers, FL 34680

GEORGIA

Griffin Commodore Program Exchange (GCPE), 1820 Haulmark Dr., Griffin, GA 30223
 Middle GA C-64 User Group, 104 McKinley Dr., Griffin, GA 30223
 Stone Mountain Users Group (SMUG 64/128), P.O. Box 1762, Lilburn, GA 30226
 Athens Commodore Users Group, One Beech Haven, Athens, GA 30606
 C-64 Friendly Users Group, 775 Kings Rd., Athens, GA 30606
 Commodore Club of Augusta, P.O. Box 14337, Augusta, GA 30919
 Savannah Commodore User Group, P.O. Box 1171, Savannah, GA 31402 1171
 Albany Commodore Amateur Computerist, P.O. Box 5461, Albany, GA 31706-5461

HAWAII

Makai Commodore User Group (MCUG), P.O. Box 6381, Honolulu, HI 96818
 Commodore Hawaii Users Group (CHUG), P.O. Box 23260, Honolulu, HI 96822

IDAHO

Pocatello Commodore Users Group (PCUG), Rt. 2 Box 48L, Pocatello, ID 83202
 PFP 64 Software Exchange, 742 E. 19th, Jerome, ID 83338
 Eagle Rock Commodore Computer Club, P.O. Box 3884, Idaho Falls, ID 83403-3884
 Banana Belt Commodore Users Group (BBCUG), P.O. Box 1272, Lewiston, ID 83501
 GEM-64, Ken Rosecrans, 407 N. DeClark, Emmett, ID 83617
 Commodore Treasure Valley/Boise Users Group (TV/BUG), P.O. Box 6853, Boise, ID 83707

ILLINOIS

PET VIC Commodore Users Group, 892 Knollwood, Buffalo Grove, IL 60089
 Fox Valley PET (Commodore) Users Group, 833 Prospect Ave., Elgin, IL 60120
 Computers West, P.O. Box 3357, Glen Ellyn, IL 60138
 North Eastern Computer Rappers of Illinois 64-128 of America (NECRIA), 220 Connors, Lockport, IL 60441
 South West Regional Association of Programmers/64 Users Group (SWRAP/64), P.O. Box 342, Bedford Park, IL 60499 0342
 Chicago B-128 Users Group (CBUG Inc.), 4102 N. Odell, Norridge, IL 60634
 Knox Commodore Club, 675 Arnold St., Galesburg, IL 61401
 Survivors of the Sixty-four Users Group (SOSUG), P.O. Box 6108, Macomb, IL 61455
 Western Illinois Commodore Users Group (WICUG), 906 W. 6th Ave., Monmouth, IL 61462
 Canton Area Commodore Users Group, 13 N. 17th Ave., Canton, IL 61520
 Meeting 64/128 Users Thru the Mail, R.R. 1 Box 151, St. Joseph, IL 61873

Champaign-Urbana Commodore User Group (CUCUG), 802 N. Parke St., Tuscola, IL 61935
 East Side Computer Club, P.O. Box 1347, Alton, IL 62002-1347
 Gateway Computer Club, P.O. Box 1839, Fairview Heights, IL 62208
 Western Illinois PET User Group (WIPUG), Rt. 5, Box 75, Quincy, IL 62301
 Southern Illinois Commodore-Amiga Club, 1707 E. Main St., Olney, IL 62450
 Decatur Commodore Computer Club (DC3), 664 W. Grand, Decatur, IL 62522
 Capital City Commodore Computer Club (5 Co), P.O. Box 2961, Springfield, IL 62708
 SPUG Computer Club, P.O. Box 9035, Springfield, IL 62791
 Chess Players' Commodore User Group, 723 Barton St., Mt. Vernon, IL 62864

INDIANA

Indianapolis Computer Club, Inc., P.O. Box 11367, Indianapolis, IN 46201
 Midwest C-64 Users Group (MW64UG), P.O. Box 9311, Highland, IN 46322
 Kosciusko Commodore User's Group, 312 E. Prairie, Warsaw, IN 46580
 Fort Wayne Area Commodore Club, P.O. Box 13107, Fort Wayne, IN 46867
 Logansport Commodore Club, P.O. Box 1161, Logansport, IN 46947
 Commodore Small Town Users Group (CSTUG), P.O. Box 161, Vevay, IN 47043
 QSI Alliance, P.O. Box 1403, New Albany, IN 47150
 Fraternal Order of Police Computer Club (FOPCC), 2535 Anthony Dr., Evansville, IN 47711
 Commodore Computer Club, P.O. Box 2332, Evansville, IN 47714
 Western Indiana Commodore Users (WICU), P.O. Box 1898, Terre Haute, IN 47808

Commodore Owners of Lafayette (COOL), P.O. Box 5763, Lafayette, IN 47903

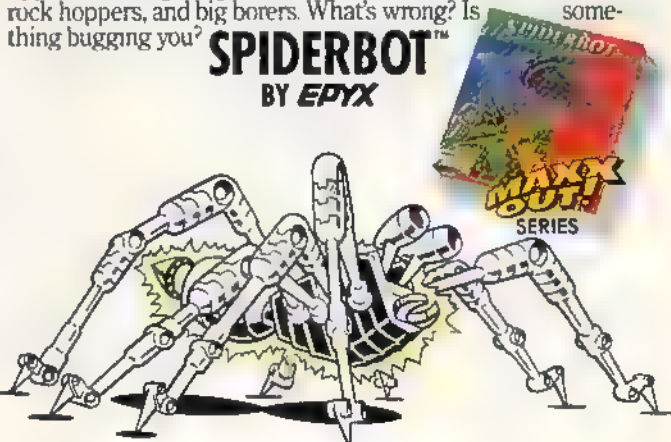
IOWA

Commodore Users Group, Ames Region (COUGAR), P.O. Box 2302, Ames, IA 50010 2302
 Capitol Complex Commodore Computer Club, P.O. Box 212, Des Moines, IA 50301
 Commodore Computer User Group of Iowa, P.O. Box 3140, Des Moines, IA 50316
 Ft. Dodge Commodore Users Group, 1606 2nd Ave. N., Ft. Dodge, IA 50501
 3C Users Group R R 3, Box 20, Charles City, IA 50616
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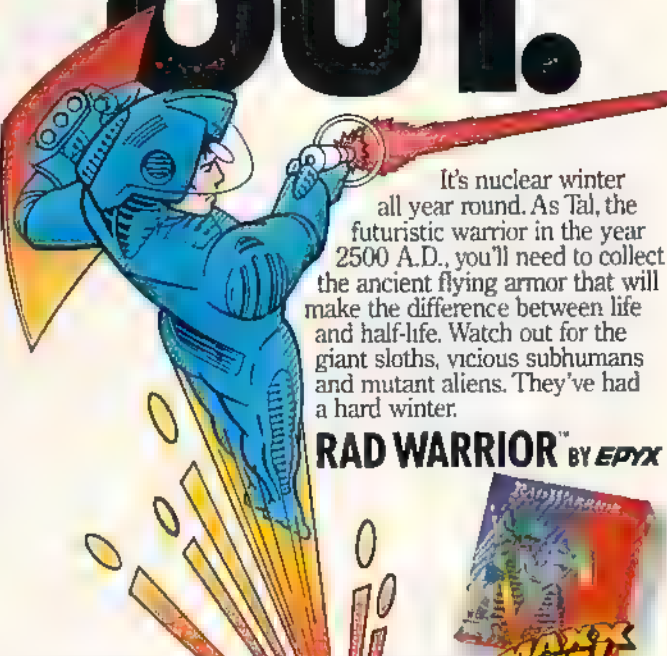
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Trap

Eric Haines

In this fast-paced action game for the 64, you enter a strange new universe where your skill and cunning are put to the test. To survive, you must trap a constantly moving sphere before your time runs out—or you trap yourself. A joystick is required.

"Trap" takes you to another universe, another dimension. Trap's world consists of an array of colored blocks hanging in ink-black space, set against a blanket of distant, sparkling stars.

Two beings inhabit this strange place, each with a geometrical form: a sphere, which continuously bounces from block to block, and a flat square, which lies atop the blocks, blinking patiently. In Trap, you're the blinking square, and your objective is to trap the bouncing sphere and use its kinetic energy for your survival.

Getting Started

Since Trap is written in machine language, you'll need to enter it with the "MLX" machine language entry program found elsewhere in this issue. When you run MLX, you'll be asked for the starting address and ending address of the data you'll be entering. Here are the values to use for Trap:

Starting Address: 0801
Ending Address: 1360

Follow the MLX instructions carefully, and be sure to save a copy of the Trap data before you leave MLX. To start Trap, simply load it as you would any BASIC program, and type RUN.

When you first run the pro-

gram, you'll see the title screen and hear an ominous sound effect to help set the mood. Press the fire button on the joystick to begin the game.

The game screen consists of a 4 × 4 matrix of colored blocks displayed in three-dimensional space. At the top of the screen is your current score, the number of lives you have left, and your high score for the session. At the bottom of the screen is a bar which represents the amount of time remaining. Use a joystick (plugged into port 2) to move the blinking square from block to block.

Staying Alive

In this universe, all life depends on motion. There are two life forms. The lower life form is a small sphere that must stay in constant motion in order to survive. The sphere can bounce in any direction, but it can't leave the grid. You, as a higher form of life, don't *have* to move, but you, too, depend on motion. The sphere is your prey, and you must trap it and use its kinetic energy.

A quirk of your character is that you spawn a trail of four discolored blocks that follow you in a snake-like manner. These special blocks are the key to trapping the sphere. The ball can't jump onto them, so you can force the sphere

into a position where it can't move, trapping it between the discolored blocks and the void of space.

There is a special situation, however. If the ball is already in midbounce and you move into a position where it must land on a discolored block, it will do so. It can't change direction in midair. Also note that you can't move over your own trail, so you must be careful not to maneuver yourself into a corner. If you do, you'll be helpless until time runs out.



Stunning graphics complement the excellent playability of "Trap."

The time bar at the bottom of the screen indicates the time you have left. It continually decreases, and when it's depleted, your system goes into shock (shown on the screen by a pulsing light). You can survive two shocks, which will be recorded as small representations of your square at the top of the screen, but with the third shock, you cease to exist. The screen pulses and fades, and you're allowed a brief period of mourning.

Trapping The Ball

When you trap the sphere, you'll receive one point for every unit of time remaining on the time bar. Anything over 200 represents very good play. After a successful trap, you advance to the next level, and the blocks change color.

You'll quickly discover techniques for trapping the ball, but since the ball speeds up every three screens, the game becomes increasingly more difficult. You don't have corresponding acceleration, so as the game progresses, planning becomes more important. Luckily, the ball ceases to accelerate after it reaches a certain speed.

If you need to pause the game, press the RUN/STOP key. The screen blanks, however, so that you can't analyze your position. The screen also changes to blue so you won't worry that something is wrong with your computer. To resume the game, press RUN/STOP again.

Modifying The Game

One nice feature of Trap is that it can be adjusted for your preferences. If you find that the game's too fast, you may want more time or a slower

pace. Or perhaps you've got super reflexes and you'd like more of a challenge. In either case, the following POKE statements allow you to customize Trap. Load Trap and type any of the following in direct mode before running the game.

To adjust the overall speed of the game, type

POKE 2910, *n*

where *n* is a number between 1 and 255. A value of 1 gives the fastest speed and 255, the slowest. The normal speed is about 170.

To control the ball's speed, type

POKE 4211, *n*

where *n* is a value between 0 and 9. Using 0 will result in the ball eventually becoming a gray blur. Using 9 will cause the ball to never accelerate. A normal value is 2.

If you want to change the rate at which time decreases, type

POKE 3258, *n*

where *n* is a value between 1 and 255. A value of 1 will leave you with something less than one second to react. Using 255 will let you trap the ball at your leisure. The normal rate is 42.

See program listing on page 93.

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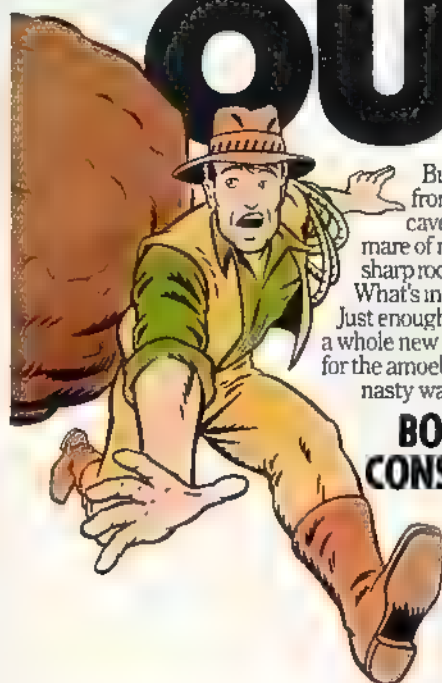
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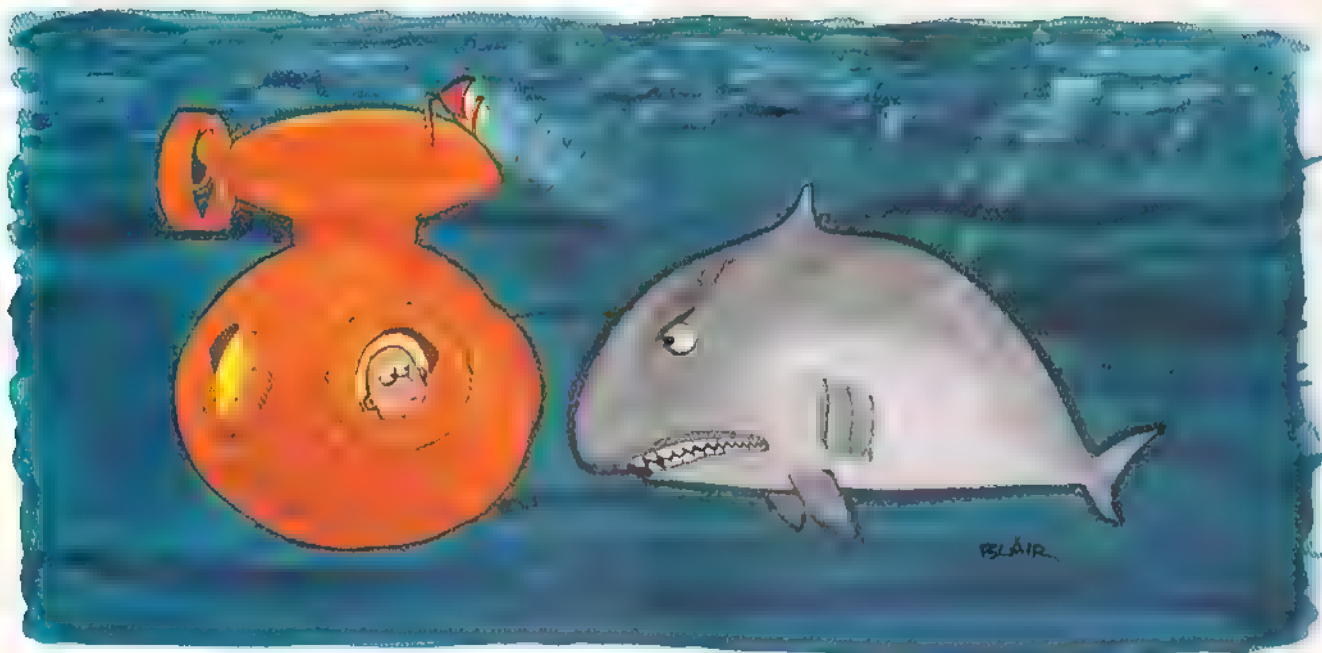


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Treasure Diver

Brian Casey

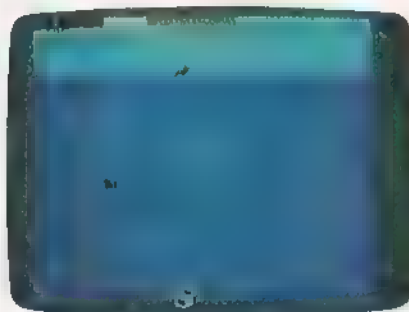
What chance does a bubble stand in an ocean full of sharks? Not much, but if he thinks fast, he may collect a lot of treasure before he pops. An enjoyable, high-speed game for the Commodore 64. Joystick required.

If you like finding treasure—and who doesn't?—you'll enjoy "Treasure Diver," an adventurous underwater game that's packed with action.

In *Treasure Diver*, you are a small bubble, floating at the top of the ocean. At the ocean's bottom is a treasure chest which drifts slowly along in the current. All that you have to do is hold your breath and dive to get the treasure.

Of course if it were that easy, it wouldn't be much fun. That's where the sharks come in. A screen full of blue sharks swimming in hunting patterns, hoping to come across a morsel of food. Stay clear of them. Pay special attention to the two black sharks (they're smarter than the blue ones) because they'll try to hunt you down.

At the top of the screen is your air indicator. When you dive, the indicator will move through the safe green area, into the yellow warning area, and finally into the red danger area. Be sure to surface for more air before you run out.



Brave the deep, shark-infested sea to bring back sunken treasure.

When a shark takes a bite out of you, he does permanent damage—you'll leak air faster. With each bite, things get worse. In waters this dangerous you won't last long, so collect as much treasure as you can as quickly as possible.

Typing It In

Treasure Diver is written entirely in machine language. Type it in using "MLX," the machine language entry program found elsewhere in this issue. When MLX asks for starting

and ending addresses, respond with the following values:

Starting address: C000
Ending address: C8C7

After you've finished entering the data, be sure to save it to tape or disk before leaving MLX.

Plug a joystick into port 2. To load *Treasure Diver*, use a statement of the form `LOAD "TREASURE",8,1` (for disk) or `LOAD "TREASURE",1,1` (for tape). If you saved *Treasure Diver* as something other than *TREASURE*, use the filename with which you saved the program.

To start the program, type `SYS 49152`. You'll be asked to select the game speed. Enter a number between 1 (fastest) and 4 (slowest). For your first game, try speed 4.

When the game begins, maneuver down between the sharks to the treasure. To capture the treasure, just touch it. It will disappear, giving you 200 points. If you get into a jam, hold the fire button down as you move—you'll go faster, but you'll also use up a lot of air.

Treasure Diver keeps the high score on the screen. If you want to pause the game, press `SHIFT-LOCK`. Press it again to resume play. To quit the game, press `F7`. See program listing on page 91. ■



THEY TALK THE TALK

By now you've probably seen all the ads for all the different "Super Cartridges" on the market. And they can talk a day, but let's get real: no cartridge is going to back up 100% of anything, no cartridge is going to turn your C-64 into an Amiga, and no fancy screens or hyperboic claims are going to give a cartridge any more power than it really has. That's why SUPER SHAPSHOT is still the best multi-function cartridge on the market. It is a product that is the result of a long process of refinement. Our policy of constant upgrading ensures you that you'll always own a state-of-the-art device. SUPER SHAPSHOT will never be "finalized" — because it's built to evolve.



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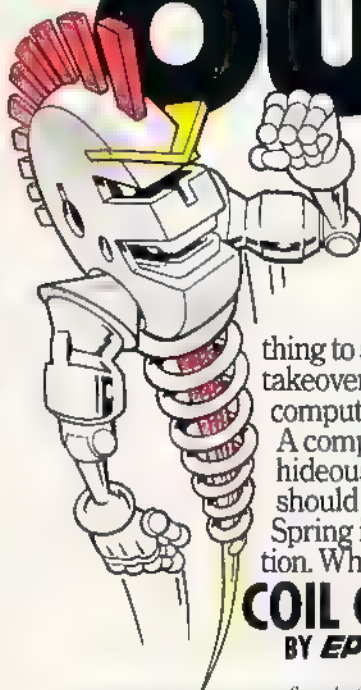
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Airborne Ranger

Although an afterword in *Airborne Ranger's* documentation has the programmers and artists at MicroProse quaking at the thought of creating an arcade game—after building their reputation on simulations—they have nonetheless done it with their usual flair.

At first glance, it may even seem that they have simply produced their own version of a popular coin-operated game for the Commodore 64. A closer look reveals that MicroProse has both enlarged and rounded out the classic scenario of a single warrior operating behind enemy lines, making of it a more complete adventure than the game that may have inspired it.

Mission, Please

There are 12 missions in *Ranger*, and two methods of play. You may assign a practice ranger, whose score will not be recorded; or use a veteran ranger, who must be saved to a separate data disk. Mission selection offers such tasks as blowing up a munitions depot, capturing an enemy officer, disabling a SAM site, freeing hostages, and many more in between.

Some missions may also combine two or more major tasks; these are explained in the briefing message that follows your selection. Scoring is based on whether or not you have accomplished your prime objective, as well as upon the number of enemy soldiers killed and the number of enemy emplacements destroyed. Besides the numerical point scores, you may also win promotions and/or medals.

Each session has a definite beginning. In rounding out the game and making of it a full-blown mission—as opposed to a set of scenarios in which you suddenly find yourself on a field of combat with no past and little future—*Airborne Ranger* begins each mission with an airdrop. There is an overhead view of the mission area, much like what you'd see if you were looking at a map, and skimming down from top screen is an aircraft. The craft may be controlled right or left by the joystick in order to help you avoid obvious trouble spots. And when you think you are ready, you begin by dropping the three

supply packages—with luck, marked in your memory so that you can find them later. Once you've used the weapons you carry, you can replenish them only by finding and recovering your supply packages.

Your own drop comes after the three supply chutes have deployed. Because you are using a paravane instead of a parachute, you have a good amount of maneuverability while still in the air. This, again, is controlled by joystick. The freedom to move will help you avoid landing atop a gun emplacement or a tank and can make it possible for you to land in a place of concealment such as a trench.

Because the name of the game is infiltration, it will not do to try to land on your objective, the reason being obvious: Anything worth destroying is also worth defending. You won't want to land in a hotbed of security and be shot down on the spot.

*An arcade-style game from
MicroProse? Yes, and a darned
good one.*

Throughout the game, control is via joystick, with only minor access to the keyboard required. In contrast to the almost full keyboard use of previous MicroProse outings, *Airborne Ranger* makes you wonder why a keyboard overlay was included: Four function keys select current weapon; the space bar determines whether you walk or crawl; a cursor key toggles between running and walking; three number keys determine the fuse delay on time bombs; and two other keys will either call for an air pickup or get you first aid. It is this welcomed simplicity of control which makes the game easy to learn and which goes a long way toward helping to classify it as arcade-style entertainment.

A New Perspective

Once your soldier is on the ground, the viewpoint shifts from a long shot to a medium shot. Your view is still from above, but is now at an angle that



brings perspective and rounding to the 3-D landscape. Enemy soldiers, pillboxes, gun emplacements, and trenches are all done with a wealth of detail that adds both realism and urgency to your task.

Slightly ahead of your soldier is a floating crosshairs pointer. This is used to aim the weapon precisely as you turn the soldier about. Depending upon the target, your chosen weapon may be a carbine, a hand grenade, a LAW rocket, or a combat knife. You aim by turning your soldier until the crosshairs is pointed at the target, and fire by pressing the joystick button.

The enemy can be wounded or killed. Wounded, he will fall to the ground, but will rise again when your back is turned. Dead, he will fall to the ground and, a moment later, disappear. Quite obviously, this particular type of house cleaning comes under the heading of conservation of sprites: Sweep the dead ones away to make way for more live ones. Yet it also serves to reinforce another tenet in the afterword of the documentation: One of the aims of *Airborne Ranger* was to emulate deadly combat without blood and guts, in order to preserve the game quality.

Once a mission has been completed—or when the countdown mission clock has reached 0—a rescue craft hovers over the Pickup Point. It is up to you to know where this is and to be there on time. Other mission endings involve your death at the hands of the enemy. In either case you will then be presented with a mission assessment in which you are awarded points, promotions, medals, or any combination of these. Then, of course, it's time to volunteer again.

Although not quite as thick as some created by MicroProse for other

games, the manual for *Airborne Ranger* is no less complete. Each mission is detailed and tactical tips for each mission are provided. In addition, there is a fascinating short historical description of Army Rangers that helps to put your computer missions in perspective. The 3-D graphics are very good, as is the sound, and the animation in the movement of soldiers and in the explosions is as good as most of what you've seen on coin-operated arcade games.

No matter what protests MicroProse may make, they have created an arcade game, and a darned good one.

—Ervin Bobo

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Sub Battle Simulator

I never knew what hit me.

The first explosion knocked out the radio, and within seconds other detonations had ripped through the submarine's pressure hull, knocking out the deck gun and torpedo tubes. I had meant to scan the horizon from the sub's control tower, but in the excitement of surfacing off the coast of Japan in 1942, I hit the periscope key by mistake. I was still trying to train its narrow field of view on my unseen attacker when other explosions rocked the boat.

No time to order a crash dive. Damage reports flooded the screen almost as fast as the Pacific Ocean flooded my unlucky boat. With the radio out, I couldn't get off an SOS, so my order to abandon ship only prolonged the inevitable. My crew and I were not rescued.

Such are the fortunes of war when you sign on for a tour of duty aboard *Sub Battle Simulator*. In this premier offering of Epyx's Master Collection, you assume the role of an American submarine skipper facing the might of the Japanese fleet, or a German U-Boat captain out to sink as much Allied shipping as possible. *Sub Battle* offers 24 American and 36 German missions, aboard six

different historically accurate submarines. The object is to complete the mission and return safely to base.

Pick Your Year

As an American, you can sail on a single mission during any year between 1942 and 1945. As a German commander, you can select a patrol between 1939 and 1945. The type of sub you command, and its armament, speed, and auxiliary equipment will vary depending on the year selected.

You can choose Target Practice mode against an enemy convoy, Single Mission, or Wartime Command. The latter places you in command at the start of hostilities. You'll sail on mission after mission, throughout the course of the entire war, until either peace is declared or you become a casualty. Be sure to select the level of difficulty you want first. The lower difficulty levels offer features denied you as you take on more difficult levels.

If you're fresh out of sub school, it's best to select a difficulty level of 1 or 2. Your weapons are more reliable, enemy convoys and planes are easier to find, and it's harder to sink your boat. After a few thousand miles of saltwater have passed under your keel, or over your conning tower, and you can command a sub in your sleep, then opt for

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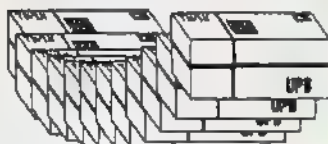
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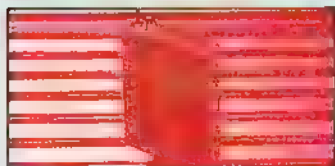
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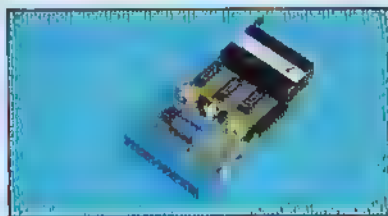
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the more difficult missions. Epyx includes a handy chart that explains the numerous differences between the different levels.

The flip side of the card lists all the keyboard functions you'll need to command your vessel. This reference is a tremendous aid to game play, since there are dozens of options available to sub skippers, and it's easy for novices to forget which key to press in the heat of battle. The function keys alone provide a periscope view, binocular view, bridge view (good for spotting aircraft), side view of submarine and surface vessels (which show depth charges), sonar, radar (if installed), five levels of maps, and a chart showing the status of the boat's equipment, food, oxygen, and estimated repair time of damaged items.

At the start of each patrol you are given specific orders. These may dispatch you and your boat to seek and destroy enemy shipping, rendezvous with shore units, or rescue downed air crews. As you leave port, you can set your own course and speed to your assigned station, or, at the lower levels, let the computer handle the navigation for you. It will suggest a course and speed, tell you how many days it will take to reach your destination, and the amount of supplies you'll use.

I seldom have problems letting the computer do my navigating, but my U-boat crew and I starved to death several times trying to reach Germany following extended patrols off the North American coast. The next time I sail that mission, I'll handle the navigating and see whether I can do better.

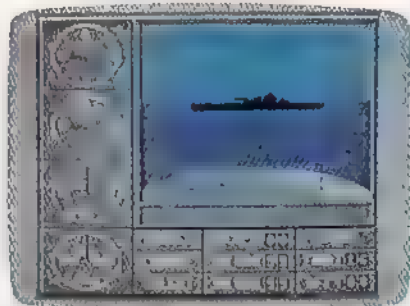
Realism

The designers have included a number of realistic touches in this outstanding simulation. If you get a radio message from headquarters, the Morse code you hear is accurate, even if the keying is a little sloppy. Don't worry about deciphering the dots and dashes yourself: The computer prints the message on the screen as it comes across.

Simulations can be made too realistic, though. In real life, it could take weeks to reach distant patrol areas. Most computer skippers would mutiny if they had to wait that long before being called to battle stations. Fortunately, *Sub Battle* lets you compress sailing times to speed up play. As a result, a single mission usually can be completed in less than an hour. When you come in contact with the enemy, the time compression drops automatically. It also drops whenever you are submerged, so you have to keep an eye on your oxygen and the charge remaining in your battery banks.

Your engines automatically change from diesel power to battery when you

dive, but you have to give the order to switch back when you surface. More than once I've popped up and increased speed to catch a fleeing convoy, only to get a message a short time later informing me that my batteries were dead. Don't forget to recharge them after you've switched to diesel.



Time compression can also be a problem when you're sailing near land. I was taking a U-boat up a narrow bay off the western coast of Ireland, curious to see if I could see anything on shore. (You can't.) I thought I had turned the boat toward the open sea when I increased speed and called up the maximum time-compression mode. Actually, I was still sailing toward land. I immediately got a *We are aground* message. I called up an overall chart of Ireland only to see my sub's cursor sail right across the island and emerge in the Irish Sea—a remarkable feat for any vessel. The same thing happened when I was commanding a U.S. sub off the northern coast of Australia. I sailed inland for a few hundred miles, turned right, and powered my way out somewhere west of Darwin, without even scratching the paint.

In most cases, when you run aground, you'll stop. I don't remember seeing it mentioned in the manual, but if you keep reducing speed, the boat will go in reverse. That's a handy way to get off a beach. Try not to run ashore too often; it's hard on the torpedo tubes.

I noticed another minor flaw when I was trapped by enemy escorts. I was forced to stay submerged until the electricity in my battery was depleted. My boat still had oxygen, so I waited to see what would happen. After a few moments, I was surprised to discover the boat was still under weigh. Even with a dead battery, I could maneuver and change speed as if nothing were wrong. It helped us survive, but I wouldn't expect that to happen on a real submarine.

The same thing proved true when my sub's pressure hull was damaged by enemy fire. I ordered a crash dive to escape the murderous shelling, fully expecting either to sink or get a message telling me that I couldn't dive. To my sur-

prise, the sub went down, survived a depth-charge attack, and behaved normally. Maybe the damage wasn't as bad as I thought, but I think we got off a little too easy for a simulation of this scope.

Frustrated U-boat Captain

The missions supposedly are based on authentic historical data, although details are sketchy on many of the German patrols due to the number of U-boats lost at sea. I recall that the Germans were very successful in sinking Allied shipping during the early years of the war. But whenever I assume the role of a U-boat captain, I'm lucky if I can spot smoke on the horizon. I played for weeks before I even saw a ship, much less got one centered in my periscope.

As an American commander, I've sent half the Japanese fleet to the bottom. Once, when my periscope was damaged, I even sank a destroyer with a difficult bow shot using only sonar bearings. My score to date as a U-boat commander is one tanker and a PT boat. Those victories came in my latest game, and now I'm under attack by three destroyers. I've tried to lose them for several days. (You have the option of saving single missions for later play.)

I've zigzagged. I've reversed course. I've tried silent running. I've dived so deep that rivets popped, and I still can't shake them. Now my oxygen is low, I'm out of torpedoes, and these escort vessels are still stuck on me like lint on Navy blues. I get the feeling that all navies aren't created equal.

Never A Dull Moment

Sub Battle can be frustrating at times, but it's never boring. I've been sunk by my own mines. At other times I've sailed through convoys without a scratch, bow and aft torpedo tubes blazing, finishing off damaged tankers with my deck gun, and knocking out waves of enemy fighters with my anti-aircraft weapons.

It's an addictive game. After an unsuccessful patrol, I'll sail into home waters, vowing to turn the computer off as soon as I get to port. Then, like a losing gambler who knows his luck is bound to change, I'll say, "Just one more patrol; just one more." Before I know what I'm doing, I've packed my sea bag and signed up for another mission.

Sub Battle Simulation is more seductive than a silver-tongued recruiting officer.

—Tom Netsel

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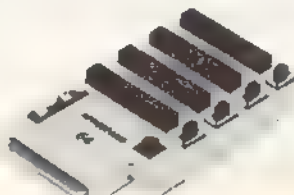
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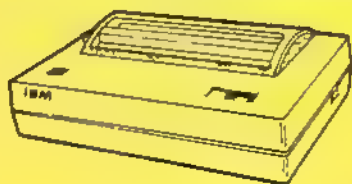
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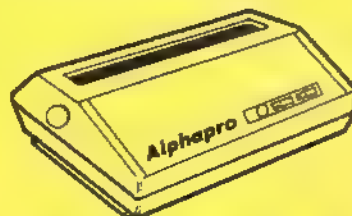
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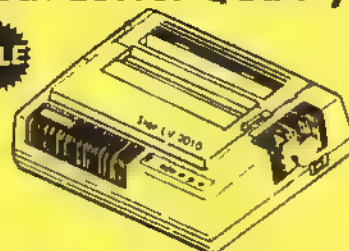
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Chernobyl

As its subtitle states, *Chernobyl* is *A Nuclear Power Plant Simulation*. Although the simulated power plant is of the same type involved in the actual Chernobyl disaster—with some American modifications—the simulation is of day-to-day nuclear power plant operation, not of the accident that happened in the U.S.S.R.

So why is it called *Chernobyl*? Obviously, the creator and the distributor are capitalizing on a name that has become a part of our language. This is not a new practice and not even a deceptive practice when viewed within the context of marketing and advertising standards. You are much more likely to take a second look at a software package called *Chernobyl* than you are to notice a package called something like "Nuclear Reactor."

Simulating Another Computer

Chernobyl is a simulation, but in this case, your computer is simulating another computer—the one that monitors and controls the workings of a nuclear power plant. As stated in the game's prologue, the author's intention was to show, in a simplified way, some of the problems and hazards involved in running such a plant. I think the program may succeed on a level not even imagined by the author.

As the computer operator, you must sign in, give the time of day and the password, and bring the plant online and into full operation. Your feedback takes the form of messages—usually a single line that appears at the top of the screen. You'll be given confirmation of some of the actions you've initiated as well as constant status reports on various parts of the plant.

Since *Chernobyl* is run strictly by keyboard interface—in keeping with the plan of simulating a computer—all commands must be typed in. To open valves, type *open* followed by the numbers pertaining to the valves you wish to open; to engage the turbine, type *power on*; to activate core draining, type *shutdown*. Core brings up a graphic representation—one of several schematics used here to show the layout and the workings of such a power plant.

How Long Until Doomsday?

One of my first questions to the author was, "How long do I have to watch all this stuff before things start going wrong?"

"Sometimes quite a while," he said.

My second question a few weeks later was, "How do I blow the darned thing up?"

In essence, his reply was that it can be done but you have to work at it. Sev-

eral people who work with atomic energy called him with essentially the same question, leaving the author to speculate that perhaps he'd done his work too well.

That depends on what he was trying to do. We'll come back to this point.

The printed documentation for *Chernobyl* consists of a booklet that explains the operation of a nuclear power plant. Even though it does not tell you how to use *Chernobyl*, the documentation should be read for an understanding of how the various elements of a nuclear plant interact. The game's real documentation is on the disk itself, accessible via the keyboard. I have mixed feelings about this.

On the one hand, an on-disk manual allows for last-minute updates. Events automatically pause when the manual is called up, which can be very beneficial if things are going wrong. The manual can be printed out if you prefer to work with hardcopy.



Unfortunately, the printed documentation gives the wrong information for accessing the manual. You have to type *manual* in order to access the game's documentation. Upon booting the game, you get about four screen pages of history on the development of and need for nuclear power plants. Although the author refrains from being "preachy" on the subject, there is no way to circumvent the message—it is there every time you boot up. Where does *Chernobyl* succeed and who will be interested?

Without being facetious, I think *Chernobyl* probably succeeds in simulating the computer controlling a nuclear power plant and definitely succeeds in simulating the boredom of being stationed at such a computer. That's no meant as a putdown.

Pulling The Graveyard Shift

The first time I tried the program was late at night: The rest of the family had gone to bed, and I was sitting before a computer that kept flashing messages telling me everything was nominal. Under the circumstances, it was easy to imagine I was pulling the graveyard shift at a real power plant.

It was even easier to imagine, considering the boredom level of the job in simulation, that it would be possible for a real operator to miss the first changes in the series of messages that are supposed to warn him or her when something's amiss. (There are audible alarms, but by the time they go off, you're in real trouble.) To me, this was the most frightening thing about *Chernobyl*: a simulation of the human frailties that could preclude disaster.

As to interest, I don't think *Chernobyl* can be approached in the way we approach most simulators. It is not something I would consider booting up because I wanted to have some fun or excitement. I do think it may have some value as a teaching tool, perhaps in a classroom situation—particularly with the graphics screens that show the parts and workings of a nuclear power plant. It might also be well for a teacher to deliberately induce meltdown just to show how a nuclear power plant can shut itself down in times of danger.

As a diversion or entertainment, *Chernobyl* fails. As a teaching tool, it succeeds.

—Ervin Bobo

Chernobyl

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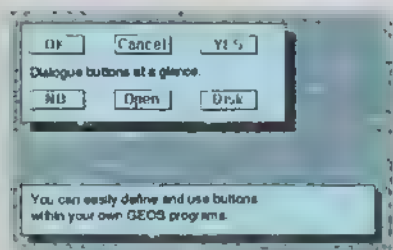


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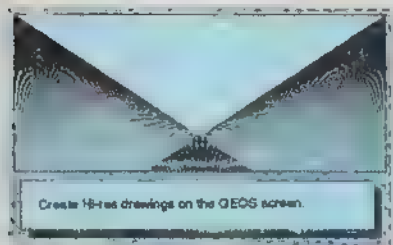
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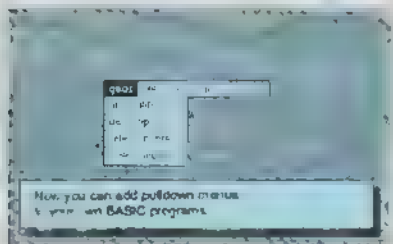
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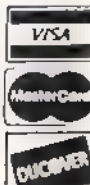
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Amnesia

You wake up in a strange hotel room in New York City. You have no clothes, and you can't remember your name or any other details of your life. If that isn't trouble enough, there's a woman here who insists you are her husband-to-be. And yes, you also left home without your American Express card.

Since you have no cash, you can't stay at the hotel. Not only have you got to find a place to stay but you also have to find something to eat. To top off all of your other problems, the state of Texas is looking for someone who looks just like you—someone who's wanted for murder.

As the manual is quick to explain, *Amnesia* (the long-awaited 64 version is now available) from Electronic Arts is, indeed, a revolutionary concept—a cross between a computer game and a novel. It has been termed the first electronic novel because of its story-like quality. The author, Thomas M. Disch, a renowned poet and science-fiction author, demonstrates the high caliber of his craft in this absorbing story of one man's race against time and incredible odds to discover his identity. And he must do it before he is executed for crimes he did not commit.

Intelligibility

One of *Amnesia's* exceptional features is its parser. It not only accepts a larger number of words than most adventure games but also accepts a more diverse combination of words. One example of such a sentence is "Take the mugger's gun and throw it in the garbage can and yell, 'Your Mamma!' then run." This unprecedented flexibility makes you feel like a character in a book.

Other adventure games entertain, but often are frustrating (the parser won't accept your sentences), or arbitrary (there is only one solution to any problem). Any experienced player of adventure games will remember sitting in front of the monitor for hours, trying words such as *open*, *push*, *unlock*, *pry*, *unfold*, *pull*, or *move*, only to find that *use* is the only word the game accepts. In *Amnesia*, there are alternative solutions to most of the problems you encounter. This gives the player a sense that anything can happen at any time.

*No clothes, no name, no
memory—and you're wanted
for murder.*

Other features of the game that I enjoy are its realism and the large scope of its setting. The game's two disks contain close to 4,000 separate locations in Manhattan, including most of the city's subway system. The narrative provides colorful descriptions of the scenery and a large cast of characters. One of these is the Wacky Wanderer, the host of a radio show not unlike Allen Funt of *Candid Camera*, who offers you 100 bucks if you can produce an elephant.

There's also a man in a blue suit who gives you a cryptic clue, and there's a former acquaintance who delivers a note you wrote to yourself in the earlier throes of your amnesia. You'll also meet a host of other people unimportant to the story but important to the mood. These include Hari Krishnas, policemen, tourists, historians, muggers, artists, cabbies, and more. Many of these characters can help or hurt you in your quest for knowledge.

In The Big Apple

Amnesia's computer model of Manhattan also contains a fairly realistic model of life in the Big Apple. If you stay out on the streets at night, you run the risk of being mugged. Begging for money too often can get you arrested. If you try to wash car windows at the Holland

Tunnel, some people will pay you, but others will merely use rude language and drive away. You are tossed out of establishments if you don't have money. If you don't eat regularly, you'll feel hungry and tired. You must sleep every night or run the risk of fainting in the middle of a street.

Besides moving around the streets of Manhattan, *Amnesia* takes your character to many points of interest, such as the New York Historical Society, the Museum of Modern Art, St. John's Cathedral, the Union Club, and Central Park. For the stay-at-home tourist, this should be fun. In fact, you may have the feeling of being in two places at the same time: at home in front of your monitor and on Forty-Second Street in Manhattan.

Another notable feature of *Amnesia* is the speed of the game's disk operation. Many text adventure games tend to have a slow data-retrieval process. The process is annoyingly long, but not long enough for you to run out for a snack. But *Amnesia's* disk operations rarely take more than a few seconds.

If you like role-playing games, text adventures, or are new to the genre, you'll like *Amnesia*. If you don't like role-playing games or text adventures, you'll still like *Amnesia*. If you are familiar with Manhattan, you'll like *Amnesia*. If you play the game and decide you don't like it, just forget I told you about it.

Read that again; you'll get it.

—Jesse Cohn

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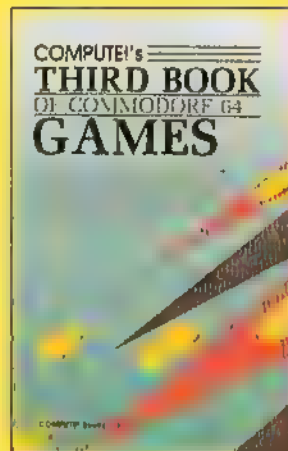
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Deliberate And Accidental Errors

Now I am confused. A letter in the January "Feedback" column asked about disk errors. Your answer said that some copy programs reproduce most disk errors. That's good. However, as you described it, the copy program Mr. Devine used duplicated the entire disk, including errors. That's bad.

Software companies include errors to prevent duplication, but some copy programs duplicate the errors, making the disk usable. And yet, some copy programs duplicate the errors and the copied disk becomes unusable.

Can you clarify?

Gene Majewski
Chicago, IL

As a general rule, an error on a disk sector makes the data on that sector unreadable and unusable. Commodore disk drives will attempt to read a sector five times before giving up and returning an error message. The five tries cause the disk drive's read/write head to knock and shudder.

Some software companies will deliberately damage one or more disk sectors on a section of the disk that is otherwise unused. When the program loads, it attempts to read the damaged sector, but not for any kind of data it contains. The program just wants to receive the error report from the drive. When the disk drive reports that something is wrong, the program continues.

This is a form of copy-protection; ordinary disk-backup programs won't copy damaged disks. However, some copy programs are able to reproduce errors. When you're making archival backups of copy-protected software for your own use, you want the errors to remain on the disk.

Ordinary noncommercial disks can sometimes be damaged physically or magnetically. If something bad happens to a disk containing normal programs or data

files, you may want to salvage whatever files are still good. In this case, the files (but not the errors) should be copied to a new disk. You don't want the errors on the backup.

Programs that reproduce errors are good only when you want to copy deliberate errors. They're not good when the damage is accidental.

Preparing The Random Number Generator

In a previous "Gazette Feedback" answer, you have a program containing the line `10 LIMIT = 44: NUMBERS = 6: X=RND(-TI)`. Your explanation says, "After seeding the random number generator in line 10..." and so on. What does `X=RND(-TI)` have to do with the program? The program works fine without the statement. I'm not trying to be rude, but I think this should be corrected.

Chris Klinger
Thonotosassa, FL

Here's an experiment you may want to try. Turn on your 64 or 128 (if you've previously used it for some other program, turn it off, then on). Type `FOR X = 1 TO 4: PRINT RND(1): NEXT` and write down the four numbers. Turn the computer off and then on. Enter the `FOR-NEXT` line again. You'll see the same four numbers. In fact, if you start with a freshly powered-on computer, the sequence of `RND(1)` numbers is always the same.

Next, try `PRINT RND(-5), RND(-5), RND(-5)`. When you put a negative number in parentheses, the `RND` function always returns the same value.

Computers are too predictable and orderly to generate truly random numbers. Instead, they start with a "seed" number and perform various mathematical operations to scramble it up. The result becomes the seed for the next random number. Putting a negative number in parentheses gives the random number generator a brand new seed.

The example program you cited was designed to pick six lottery numbers at random. But since the `RND` function returns the same series of numbers, the program would always choose the same six numbers, as long as it was the first program to run after the computer was turned on. The `RND(-TI)` line uses a negative

seed, so it forces a specific number into the random number generator. But the reserved variable `TI` counts how many jiffies have passed since you turned on the computer. (A jiffy is 1/60 second.) If you ran the program two seconds after turning on the computer, you'd get different results from those you'd get if you ran the program three seconds after turning it on.

Hi-Res Color Blocks

When you use the BASIC 7.0 `PAINT` command on the 128 with multicolors close together, blocks of color sometimes appear on the boundary, overlapping to the other side. Can you explain why this happens?

George Smid
Upper Burnie, Australia

On both the 64 and 128, the hi-res and multicolor hi-res screens have two components: the bitmap and the color map. The bitmap takes up 8000 bytes (64,000 bits) of memory. Each bit corresponds exactly to one of the pixels on the 320 X 200 screen (64,000-pixels).

A hi-res pixel can be displayed in the foreground or the background color. In multicolor hi res, the pixels are twice as wide, but there are four colors instead of two. Since the 64 and 128 have 16 different colors, there are 256 possible combinations of foreground and background colors, which are numbered 0-255 and stored in a byte. If the designers of the 64 gave every one of the 64,000 pixels its own byte for controlling color, the color map would need 64,000 bytes, which would just barely fit into memory. Thus, the color bytes are built to handle more than a single pixel.

Each of the 1000 bytes of hi-res color memory controls the foreground and background colors of a 64-pixel area—an 8 X 8 chunk of the screen. Within the 8 X 8 area, you're only allowed to have one foreground and one background color. When you use the 128's `PAINT` command, the computer fills in the bitmap and the color map. If you have some background pixels that are black and then you change the background color within an 8 X 8 color area to red, all background pixels are affected. The previously black pixels turn red. There's no way to work around this limitation of hi-res color memory, except to be aware of the 64-pixel neighborhoods.

Using KoalaPad Pictures On A 64

I saw a 128 KoalaPad picture loader in the feedback section of the November 1987 issue. I have a Commodore 64 and would like to use KoalaPad files in my own BASIC programs.

Mark McGee
Westwego, LA

Each picture file is 10,000 bytes long. The first 8000 bytes are the actual picture. The next 1000 determine one color and the last 1000 are for colors 2 and 3. The fourth color in multicolor bitmap mode is the screen background. The program that follows sets up the bitmap at 8192 (\$2000) while keeping screen memory at 1024 (\$0400) and color at 55296 (\$D800).

Koala filenames have a prefix consisting of CHR\$(1) (CONTROL-A) as the first character, followed by PIC and then a letter. This is why the OPEN in line 140 uses a question mark wildcard as the first character in the filename. Exit the example by pressing the space bar.

```

AS 100 REM RESERVE MEMORY AFTE
      R 8192
EK 110 POKE 52,32:POKE 51,0
AB 120 POKE 56,32:POKE 55,0:CL
      R
FS 130 REM BLOAD KOALA FILE AT
      8192
SQ 140 OPEN 1,8,0,"?PIC C*"
PK 150 S=8192:S1=S+8000:S2=S+9
      000
HK 160 POKE 185,0:POKE 780,0
GH 170 POKE 781,S AND 255:POKE
      782,S/256
QE 180 SYS 65493:CLOSE1
EM 190 BM=53265:POKE BM,PEEK(B
      M)OR 32
JS 200 REM LOCATE BIT MAP AT 8
      192
KJ 210 LB=53272:POKE LB,PEEK(L
      B)OR 8
BH 220 MC=53270:POKE MC,PEEK(M
      C)OR 16
JA 230 REM POKE SCREEN MEMORY
HJ 240 FOR I=0 TO 999
MQ 250 POKE 1024+I,PEEK(S1+I)
GB 260 NEXT
AB 270 REM COLOR MEMORY
HR 280 FOR I=0 TO 999
AM 290 POKE 55296+I,PEEK(S2+I)
FD 300 NEXT
AK 310 REM DO THE REST OF YOUR
      PROGRAM
PG 320 REM THIS ONE DISPLAYS A
      SPRITE ON THE SCREEN
SD 330 V=53248
HX 340 POKE V+21,1:X=100:Y=100
RC 350 POKE 2040,13:FOR I=832
      [SPACE]TO 895:POKE I,25
      5:NEXT
AS 360 DX=RND(1)*8-4:DY=RND(1)
      *8-4
EC 370 X=X+DX:Y=Y+DY:POKEV,X:P
      OKEV+1,Y
FM 380 IF X<20 THEN DX=RND(1)*
      4+2
AP 390 IF X>250 THEN DX=RND(1)*
      4-6
AE 400 IF Y<20 THEN DY=RND(1)*
      4+2
SF 410 IF Y>250 THEN DY=RND(1)
      *4-6

```

```

BF 420 GET AS:IF AS<>" " THEN3
      70
PP 430 REM RETURN TO TEXT MODE
      WHEN A SPACE BAR IS PR
      ESSED
CB 440 POKE BM,PEEK(BM)AND 223
      :POKE MC,PEEK(MC)AND 23
      9

```

Saving ML Files

I have a long BASIC loader program that POKEs machine language (ML) data into memory. I know the starting address and would like to do a binary save of this program to reduce its size and load time, but I need to know its ending address plus 1. Can you furnish lines to add to the loader which will display the ending address after the data has been entered?

Brian Vaughan
Alameda, CA

Determining the ending address of the ML program from your BASIC loader should be relatively easy. The loader should contain a statement such as FOR I = 49152 TO 49499: READ A: POKEI,A: NEXT which READs and POKEs the ML data into memory. Here, the starting and ending addresses of the ML program would be 49152 and 49499, respectively. Another possibility is that the loop would look like this: FOR I = 0 TO 347: READ A: POKE 49152+I, A: NEXT. In this case, the starting and ending addresses would be 49152+0 and 49152+347, the same as the first example.

Once you know these addresses, you can carry out a binary save of the program. The lines below demonstrate how to save a portion of memory to disk.

```

DF 100 SA=49152:EA=49500:FS="E
      XAMPLE"
CB 110 SH=INT(SA/256):SL=SA-SH
      *256:EH=INT(EA/256):EL=
      EA-EH*256
GE 120 OPEN1,8,1,"0:"+FS
RS 130 POKE780,253:POKE253,SL:
      POKE254,SH:POKE781,EL:P
      OKE782,EH
RH 140 SYS65496:CLOSE1

```

To be certain the ML program is in memory before the save, place these lines at the end of your loader.

Line 100 defines the starting address of your ML program as SA, its ending address plus 1 as EA, and the filename for the binary file as FS. Substitute the starting and ending addresses of your ML program in this line along with a suitable filename. The filename you choose can be as many as 16 characters in length. Make sure you pick a filename that doesn't already exist on the disk.

After calculating the low and high bytes of the starting and ending addresses of the ML program, line 120 opens the file FS to drive 0 for saving. If you have a second disk drive and have changed your disk drive number to 9, you'll need to change

the 8 in this line to a 9. Line 130 stores the values required by the Kernal SAVE in the A, X, and Y registers. Finally, line 140 SYSes to the Kernal SAVE routine at location 65496 and closes the file.

On the 128, you can use the BASIC command BSAVE to carry out a binary save to disk. The format for this command is:

BSAVE"filename",Ddrive number,Ude-
vice number,Bbank number,Pstart
address TO Pending address+1

Drive number is either 0 or 1 (0 is the normal value for single-drive systems). Device number defaults to 8, the standard value for a single-drive system. Bank number is a number between 0 and 15 specifying which bank of memory holds the data you're saving.

For example, to save binary data in memory locations 4864-5499 in bank 0 as "TEST", you'd use the following:

BSAVE"TEST",B0,P4864 TO P5500

The Multi-Statement THEN Trap

According to the Commodore 64 manual, you can use several statements separated by colons on one program line. However, the following program doesn't work:

```

10 X1=25:X2=25
20 IF X1=0 THEN 100:X2=X2+X1
30 PRINT X1:X2
40 STOP

```

When I run the program, both X1 and X2 are 25, but X2 should equal 50. Can you please explain?

James E. Hammond
Denver, CO

Line 20 contains the bug. An IF-THEN statement checks a condition for being true or false. The condition tests X1=0 in this example. If it's true, the command after the THEN is executed, plus any other commands on that line. However, a false condition causes the program to jump to the next line.

The section of line 20 where you make the assignment X2=X2+X1 can never happen. Consider what occurs if X1 equals 0: The program jumps ahead to line 100, skipping over X2=X2+X1. And if X1 doesn't equal 0, the IF-THEN drops through to line 30, again skipping over the assignment.

This feature of IF-THEN can be very useful when you want a single condition to trigger multiple commands. Just remember that an IF-THEN controls everything on the current line that follows it.

Supercolliders

I am working on a program using sprites, but I have run into a problem. I know the command PEEK(53278) to test whether two or more sprites collide, but I wonder if you can tell which

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sprites collided. It would be very helpful.

Jesse Coats
Ames, IA

Location 53278 is a hardware register within the Video Interface Controller (VIC) chip's area of memory. Every time the VIC chip redraws the screen, it updates the sprite-to-sprite collision register at 53278. The eight sprites, numbered 0-7, correspond to the eight bits, also numbered 0-7, in the number you PEEK from this register. The sprites correspond to the following values.

Sprite Number	Value PEEKed
0	1
1	2
2	4
3	8
4	16
5	32
6	64
7	128

If sprites 2 and 3 are currently involved in a collision and no other sprites are colliding, when you PEEK(53278), you'll get the number 12 (a 4 for sprite 2 plus an 8 for sprite 3). If sprites 0 and 6 are colliding, you'll receive a 65. A collision only counts when the foreground colors of two sprites overlap. If the foreground pixels of one sprite happen to intrude on the background pixels of another sprite, it's not a collision. Usually, the foreground color is the visible portion and the background color is the same as the screen's background color. You can set the foreground color to equal the background color, which generally makes the sprite invisible, but the rules for collision still apply. Also, when you're using multicolor sprites or multicolor screen mode, two of the colors count as foreground (collision) colors and two count as background colors.

The only sprites that can collide are the ones currently turned on, which are controlled by the register at 53269. If two sprites are turned on and completely off the visible screen, a collision will still count.

Programmers have always had problems with multiple sprite collisions. Let's say that, at a given moment, sprites 0 and 1 were colliding and at the same time, somewhere else on the screen, sprites 3 and 7 were colliding. Register 53278 would hold the number 139 (1 + 2 + 8 + 128). If you were concerned about the status of sprite 0, you'd know that it was colliding with another sprite. However, you wouldn't know which one. It could be a collision of sprites 0 and 1, 0 and 3, or 0 and 7.

One solution would be to selectively turn off various sprites. In the example above, turning off sprite 7 would eliminate the collision between 7 and 3, which would leave only the overlap between 0 and 1. One drawback of this method is that turning off sprites makes them flicker. Also, when you PEEK 53278, the number there disappears until the screen is redrawn in 1/60th second. In machine language programs, you must insert a delay loop before you read the collision register.

A second solution, when you can't decide which sprites are overlapping, is to read the x- and y-positions from registers 53248-53264. If several sprites are colliding, you can assume that the sprites near each other are involved in a collision. ■

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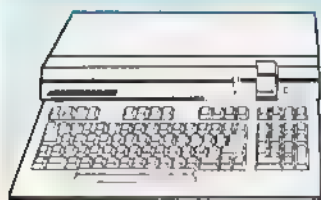


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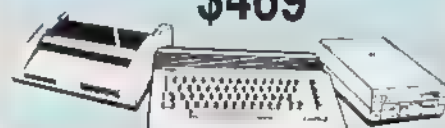
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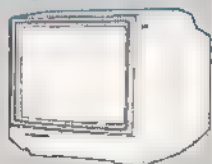


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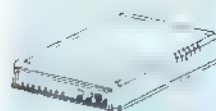
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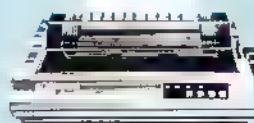


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BASIC for beginners

Larry Cotton

Last month we began writing a complete four-function math drill program. We left off with a GET statement at the end of our math menu. Let's finish the program:

```
160 N=10:Q=RND(-TI):REM SE  
E ARTICLE
```

The variable N controls problem difficulty (skill level). It is the largest number added to or subtracted from; the largest multiplication table; and the greatest answer in a division problem.

Ten is an average difficulty level, which you can change—before the program is run, of course—to suit the user's ability.

Handling The Chores With Subroutines

We need several subroutines for presenting the four types of math problems. You might recall that ON-GOSUBs are an efficient way to access them, so we need to convert the four possible strings ("1", "2", "3", or "4") from line 150 into numeric values, say, X. Remember that the VAL function does just that:

```
170 X=VAL(AS)
```

Our main program loop starts at the next line, which is a problem counter, P. It starts at 0 each time the program is run and is incremented by 1 for each problem:

```
180 P=P+1
```

Values of X (line 170) are used in a pair of ON-GOSUBs to send control to the subroutines for generating and displaying the problems:

```
190 ONXGOSUB280,280,220,220  
200 ONXGOSUB350,360,370,410
```

Note carefully that each of the above lines is executed separately; that is, a value of X=1 will access

first the subroutine at line 280, then the subroutine at line 350. A value of X=3 will access, in sequence, the subroutines at lines 220 and 370.

We then call another subroutine to check the answer, and send control back to line 180 to begin creating a new problem:

```
210 GOSUB420:GOTO180
```

A Two-Entry-Point Subroutine

The subroutine called by line 190 runs from lines 220 to 340 and has two entry points. Only the last part of the subroutine (beginning at line 280) is used for addition and subtraction (X is 1 or 2); the entire subroutine starting at line 220 is necessary for multiplication and division (X is 3 or 4).

Let's begin at the second entry point since that's the order in which they're called in line 190:

```
280 A=INT(N*RND(1))+1  
290 B=INT(N*RND(1))+1
```

These are our primary RND function lines; they generate two numbers from 1 to N, which was defined in line 160 and discussed above. Both numbers are used in addition and subtraction problems, though only one is used in multiplication and division problems.

Next, we should add a line to handle a peculiarity of subtraction problems. Since we want our answers to be nonzero and positive, A (the number subtracted from) must be larger than B (the number to subtract):

```
300 IF(X=2)AND(A<=B)THEN280
```

We use an IF-THEN to check whether we're subtracting (X is 2) and whether A is less than or equal to B. If both conditions are met, we must generate more pairs of random numbers until A is greater than B. (This explains the occasional short delay in generating subtraction problems.)

Color-Coded Screens

The next lines set the stage for displaying the problems on a blue screen. Later we'll color-code the screen for right (green) and wrong (red) answers.

```
310 PRINT"(CLR)":POKE53281,6:R  
EM FOR C16 AND C+4 - USE CO  
LOR0,7 INSTEAD OF POKE  
320 FORJ=1TO7:PRINT:NEXT  
330 PRINT:PRINTAB(6)"PRESS ONL  
Y RETURN FOR ANSWER"  
340 PRINT:PRINTTAB(13);:RETURN
```

Now, write the lines for the subroutine's first entry point, that is, for multiplication and division problems (X is 3 or 4).

```
220 IFFLAG=1THEN280
```

Here we're checking to see whether a signal flag has been "raised." We'll raise that flag later in the program (see line 530) by making the variable FLAG (FL) equal to 1, signifying that the program has been run through at least once, and that the user wants to continue.

If FL is 1, we don't need to ask again which multiplication or division table to use; the program will skip lines 230-270. However, at the first run, FL=0 and control will fall through to line 230:

```
230 PRINT:PRINTTAB(13)"TABLE";  
240 INPUTTS  
250 T=VAL(TS)
```

We use INPUT because the user may need to type two digits. T will become one of the numbers to be multiplied in multiplication problems or the number to divide by in division problems.

Now we must check to see whether the table value is greater than the previously selected skill level (line 160) or less than 1 (we will not present problems with numbers less than 1):

```
260 IFT>NTHENPRINT"{3 UP}":GOT  
O230  
270 IFT<1THENPRINT"{3 UP}":GOT  
O230
```


This brings us to lines 280-340, which we've already written. The sole RETURN in line 340 suffices to end the subroutine, no matter whether the entry point is at line 220 or 280.

Incidentally, if you were writing a program like this from scratch, how would you know where the subroutines would be? That is, how would you know, when writing line 190, that the subroutine entry points would be at 220 and 280?

You probably wouldn't. It's a good idea to write the subroutine(s) at distant, easy-to-remember line numbers (for example, 500, 1000, 1500, and so on), then (mostly for neatness) renumber the program with a renumbering utility such as "Renumber 64" in the November 1987 issue.

Displaying The Problems

Next, we write the subroutines for actually displaying the problems. These are called in line 200, which is encountered upon RETURN from line 340. First for addition:

```
350 PRINTA"+"B="";:C=A+B:RETUR
N
```

Then for subtraction:

```
360 PRINTA "-" B "=";:C=A-B:RE
TURN
```

For multiplication, it would be nice if the problem were displayed with the chosen table value T displayed first sometimes, and second other times. That sounds like another chance to use RND:

```
370 L=INT(2*RND(1))+1
380 ONLGOTO390,400
```

These two lines cause the program randomly to GOTO line 390 or 400, depending on whether L is 1 or 2.

```
390 PRINTT"X"A="";:C=A*T:RETUR
N
400 PRINTA"*"T="";:C=A*T:RETUR
N
```

Note that we can print X on the screen to signify *multiplied by*, even though the computer's BASIC interpreter recognizes only *. Last, for division:

```
410 PRINTA"/"T="";:C=A:RETUR
N
```

We print / to the screen to mean *divided by*, which is the same sign the computer recognizes in its computations. T—the multiplica-

tion or division table value—has been gathered from the user in lines 240-250.

Calculating The Answers

In all four problem-generating lines, the value C is calculated; it's the right answer to the problem. Calculating C in addition and subtraction problems is easy: $A+B=C$ (line 350) and $A-B=C$ (line 360).

Multiplication is slightly more difficult. We must employ the user's table value T and only one of the randomly generated numbers (A is chosen arbitrarily) to create the answer: $C=A*T$ (lines 390 and 400).

Division is the trickiest. If the user picks a table value T of 7, then 7 is used as the number to be divided by.

Our difficulty level is 10, so our two randomly generated numbers—A and B—will be in the range 1-10. What do we do with them?

The answer is to *premultiply* one of them (say A) by T (in this case, 7). That will create the number to be *divided into*. The answer will then be the random number: $C=A$ (line 410). B isn't used.

Checking The Answers

Back at line 210 we called a subroutine at 420 to check the answer. Here's how it starts:

```
420 DS="":INPUTDS
430 D=VAL(DS)
```

D is now the user's answer. We should compare it with the right answer (C) and, if they are equal, send control of the program to the right-answer routine, which begins at line 480:

```
440 IFC=DTHEN480
```

If the answer is wrong (C doesn't equal D), control falls through to line 450, which begins the wrong-answer routine:

```
450 POKE53281,2:REM FOR C16 AN
D C+4 - USE COLOR0,3 INSTEAD
OF POKE
460 PRINT:PRINTTAB(12)"THE ANS
WER IS"C
470 GOTO 510
```

These three lines turn the screen red (color code for wrong answers), print the correct answer C, and send control to line 510.

Line 440 says that if $C = D$, control should go to the right-answer routine, which begins at

line 480:

```
480 POKE53281,5:REM FOR C16 AN
D C+4 - USE COLOR0,6 INSTEAD
OF POKE
490 PRINT:PRINTTAB(16)"GOOD!"
500 K=K+1
510 PRINT:PRINT"PRESS RETURN T
O CONTINUE OR Q TO QUIT."
```

Line 480 turns the screen green (color code for correct answers) and line 490 prints a complimentary message.

Line 500 is a counter for correct answers. K begins at 0 (as do all variables when a program is first run) and is incremented by 1 for each correct answer.

Line 510 prints a message to offer the option to continue (press RETURN) or quit (press Q). Let's GET the user's response:

```
520 GETBS:IF (BS<>CHR$(13))AND(
BS<>"Q")THEN520
```

We'll cover the CHR\$ function later. This IF-THEN statement says that if the user doesn't press either RETURN or Q, the program will just loop at line 520. The response if the RETURN key is pressed:

```
530 IFBS=CHR$(13)THENFLAG=1:RE
TURN
```

We referred to this line when we explained line 220. Up to this point FLAG (FL) has been 0. But when the user signifies (by pressing RETURN) that he or she wants to continue, line 530 makes FLAG=1. We have literally raised a flag as a signal, and it stays raised until the program is run again.

Control falls through to line 540 if Q (to quit) is pressed. The screen is cleared and colored blue:

```
540 PRINT"{CLR}":POKE53281,6:F
OR C16 AND C+4 - USE COLOR0
,7 INSTEAD OF POKE
```

Keeping Score

Finally, we need to print out the score. K is our correct-answer counter and P is the number of problems presented:

```
550 PRINT:PRINT"SCORE:"K"CORRE
CT OUT OF"P"PROBLEMS
```

A complete listing is found in the Program Listings section. Try the program yourself at any skill level (line 160) you wish, or you can encourage a child to practice his or her homework with it.

See program listing on page 90. ■

Fred D'Ignazio
Contributing Editor

In this month's mailbag I received a letter from Art Oswald of Goshen, Indiana. Art was responding to my article in the November *COMPUTE!* magazine about computers of the future. He wrote: "In the future, the phrase 'I wonder' will become obsolete. I won't have to wonder what would happen if, or wonder what something was like, or wonder how something might be. I would just ask my computer, and it would simulate by means of holographic projection anything my imagination could come up with."

Now, I ask you, Art, is this something to look forward to or something to dread?

I have a new science-fiction book coming out which deals with this subject—the effect of computers (and electronic media, in general) on the human imagination. The book is *Robot Odyssey I: Escape from Robotropolis* (Tor Books, April 1988). Listen to two teenage boys carrying on a conversation in the year 2014: *We think plenty using computers, but we don't imagine. We don't have to imagine what the fourth dimension is, or what will happen if we combine two chemicals, or what the dark side of the moon looks like. The computer is there a step ahead of our imagination with its fantastic graphics, cartoons, and music. We no longer imagine because the computer can do our imagining for us.*

"So why imagine?" Les said. "My pop says most people's imaginations are vague and fuzzy anyway. If the computer imagines stuff for them, it'll probably be a big improvement."

Les is right. If the computer "imagines" something, it is usually based on a database of facts, the vision of an artist, or a scientific model created by experts. How could our puny imaginations compete

with images that are this inspired, detailed, and exact?

Frontiers Of Knowledge

Science-fiction writers think a lot about new worlds of wonder. It is the human desire to "go boldly where no man has gone before" that is among our more noble impulses. It may even be the "engine" that drives us to innovate, invent, and take risks. Without this engine, we might sink into a kind of emotional and intellectual swamp. Life could become extremely boring. Every time we contemplated a decision, we would first ask our computer, "What if?" and see what the consequences might be. Knowing too much might even paralyze us and cool our risk-taking ardor.

Imagination Amplifiers

Art writes that the phrase *I wonder* may be rendered obsolete by computers, but I'm not certain that he's right. Instead, I think that we could use computers to stimulate our imagination and make us wonder about things even more.

Where does our imagination come from? I picture the imagination as a Lego™ set of memory blocks stuffed into the toy chest of our mind. When we imagine something, we are quickly and intuitively building a tiny picture inside our heads out of those blocks. The blocks are made up of images, tastes, smells, touches, emotions, and so on—all sorts of things that we've experienced and then tucked away in a corner of our minds. The quality of what we imagine depends on three things: how often we imagine, the quantity and diversity of blocks that we have to choose from, and our ability to combine the blocks in original—and piercingly true—ways.

Most of us have "pop" imaginations created from images sup-

plied to us by pop culture. We read popular books, see popular movies, watch the same sitcoms and commercials, and read the same news stories in our newspapers. It's no wonder that much of what we imagine is made up of prefab structures derived, second hand, from society's small group of master "imagineers." Electronic media has made it possible for these imagineers to distribute their imaginations in irresistible packages. If you have any doubt, ask an elementary-school teacher. Her students come to school singing jingles from commercials and write "original" compositions which really are thinly disguised copies of toy ads, movies, and Saturday morning cartoons.

Where does the computer fit into this picture? It could be our biggest defense against the imagination monopoly which the dispensers of pop culture now have. If we can tell the computer "I wonder" or ask it "What if?" it will work with us to build compelling images of what *we* imagine. If the process is interactive, and we can imagine in rough drafts, then we can polish, ornament, and rework our images as easily as a child working with sand on a beach. Then maybe the images inside our heads will be from imagination experiments that we do with our computers and not stale, leftover images pulled from the refrigerator of pop culture.

What do you think, readers? What have computers done to your imagination? What might they do in the future? Write:

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Todd Heimarck
Contributing Editor

Last month, we looked at some strategies for speeding up BASIC programs. Here's one more idea: Throw BASIC out the window and convert the program to machine language (ML).

But what if you don't know ML and have no plans to start learning it? No problem; just buy a BASIC compiler. There are several good compilers available for the 64 and 128. Let's look at what they do to speed up BASIC.

ML: The Bottom Line

Ultimately, the only language your computer understands is machine language, the language of the machine. What we call BASIC is really just another ML program. When you turn on a 64 or a 128, the program called BASIC automatically runs. (On other computers, such as the IBM PC, you start out in DOS and if you want to use BASIC, you must load it from a disk.)

Commodore BASIC is an *interpreted* language. When a program runs, the computer starts at the beginning and handles the individual BASIC commands one by one. A good illustrative example is the PRINT command, which is very flexible. It can print numeric variables, string variables, calculations, literal strings, or literal numbers—PRINT A: PRINT A\$: PRINT 3 + 5, TAN (A * B): PRINT "PLEASE WAIT": PRINT 5.

When the BASIC interpreter sees a line that includes PRINT A\$, it looks up the PRINT command and starts to evaluate the parameters following it, which might be variable names, functions, calculations, or several other possibilities like parentheses. After figuring out that A\$ is a variable, the interpreter goes off into variable memory to find the string. It searches sequen-

tially through every currently defined variable until it finds the right one. Then it goes to the routine for printing the string. All of this happens *while the program is running*.

Compilers handle a lot of the busywork in advance. A compiler would assign the variable A\$ to a specific place in memory. Then, when it's ready to PRINT A\$, the compiled program already knows that it's a string (not a number) to be printed, and it knows where the string is located. In effect, a compiler translates BASIC commands into their ML equivalents, taking care of many details (like where variables live) in advance.

Adjusting Clock Speed

One more speed-up trick is worth mentioning. If you have a 128, you can type FAST to instantly double the speed of all BASIC and ML programs. It works great in 80-column mode. In 40-column mode the screen goes blank, although programs will still run without the visible screen. The FAST command doubles the speed of the internal clock. Note that this clock is separate from the jiffy clock and the two time-of-day clocks.

A Commodore 64 uses a 6510 processor and has only one clockspeed: 1 MegaHertz (MHz), which means the clock ticks a million times a second. Each tick is called one *cycle*. The 128's 8510 processor can operate at two clockspeeds: 1 MHz or 2 MHz. When you double the speed of the clock, every machine language instruction executes twice as fast.

By way of comparison, the original IBM PC had a clockspeed of 4.77 MHz, which might lead you to believe that the PC is four to five times faster than a 64.

The IBM uses a different processor, however, which complicates the answer. Commodore's Jump to SubRoutine (JSR) command, for example, uses six clock cycles. Given

1 million cycles per second, you could spend one second executing about 167,000 JSRs. The equivalent ML command on the IBM PC is CALL, which takes either 19 cycles or 28, depending on whether you're staying within the current 64K address space. With a clockspeed of 4.77 MHz and 19 cycles per instruction, you could execute about 251,000 CALLs, which is faster than the 64, to be sure, but only by a factor of about 50 percent, *not* 500 percent.

IBM PC machine language consistently uses more clock cycles per instruction. Comparing a register to an immediate value (CMP #13, for example) takes 2 clock cycles on the 64, and 4 on the PC. The 64 decrements a number in memory in 6 cycles, versus the PC's 15. Subtracting takes 2–6 cycles on the 64, 3–17 on the PC.

The IBM has a faster clock, but a slower machine language. When you average it out, an ML program for an IBM PC running at 4.77 MHz is roughly twice as fast as the equivalent program for a 1 MHz Commodore 64. And a 128 in FAST mode runs ML programs at about the same speed as an original IBM PC. You can expand a 128 to 640K (same as the original PC), although you have to keep programs and variables within 64K banks (also the same as the original PC).

So if you've thought about changing from a 128 to an inexpensive 4.77 MHz PC clone, think again: Is it really an upgrade? You won't gain any speed. If you're set on buying a speedier computer, there are faster clones available (up to 16 MHz), and there are some excellent (and extremely fast) 68000-based computers (including the Amiga, Macintosh, and Atari ST).

machine language programming

Formatting Text

Jim Butterfield
Contributing Editor

Have you ever loaded a file (perhaps from a bulletin board) into your word processor, only to find that each and every line has a return after it? Removing the returns manually is a tedious job. How can we write a program to perform this task?

Let's take a closer look at exactly what we want to do. We don't want to remove *all* the returns—that would put all the text into one huge block. Load a file into your favorite word processor. What makes a paragraph? There are two possibilities.

First, a paragraph is indicated any time there are two return marks in a row. (In your word processor, carriage returns may be visible or invisible. Some word processors let you toggle carriage-return visibility.) Secondly, some people use the system that a single return ends a paragraph and the next line is indented with several spaces (depending on the writer).

Start With The Rules

Let's write a program that strips all the extra carriage returns out of a file. We'll use these rules:

1. Two consecutive returns will be changed to a single return.
2. A return followed by a space is left unchanged.
3. A return at the end of the file is left unchanged.
4. Other returns are changed to space characters.

There are many ways to write any program, but here's my plan of action. We'll use a flag to tell whether or not the previously read character is a return character. If it is, we'll look at the current character to see what action we should take. This procedure will make it easy to follow the rules stated earlier.

To make things easier, we'll open the input and output files

from BASIC. When the machine language program finishes executing, we'll use BASIC commands to close the files.

If you just want to use the program, type in the BASIC program and save it to disk before running it. When you're ready to see how the code works, read the following section.

In Machine Language

Since this is a rather small program, we can fit it into memory at 8192 (\$2000 hex). This area is available on both the 64 and the 128.

The first section of machine language is a subroutine to output to file 2. We must save the A register (to the stack) when we call CHKOUT (\$FFC9).

```
$2000 PHA
      LDX #502
      JSR $FFC9
      PLA
      JSR $FFD2
      JSR $FFCC
      RTS
```

Next comes the main entry point. We'll jump here from BASIC. First, we'll set the flag (at \$FC) to 0:

```
$200E LDX #500
      STX $FC
```

Now we'll read a character from the input file. The program will loop back to here each time it needs input.

```
$2012 LDX #501
      JSR $FFC6
      JSR $FFE4
      PHA
      JSR $FFCC
      PLA
```

We now copy the status to a storage location (\$FD) so that we can later check for the end of the file.

```
$201F LDX $90
      STX $FD
```

If the flag is not set, leap ahead to \$203C.

```
$2023 LDX $FC
      BEQ $203C
```

The flag is set—we're looking at a character following a return. Using the X register to hold the first character, we check for a space:

```
$2027 LDX #50D
      CMP #520
      BEQ $2033
```

If it's not a space, look for a second return:

```
$202D LDX #520
      CMP #50D
      BEQ $2042
```

Now we output the characters from the X and A registers. (Notice how we changed the first character to a space at the address \$202D above.)

```
$2033 PHA
      TXA
      JSR $2000
      PLA
      JMP $2042
```

The above jump to \$2042 outputs the second character.

This code takes care of the situation when the code is not set. First, check to see if the new character is a return.

```
$203C LDX #501
      CMP #50D
      BEQ $2047
```

If we find a return, we skip the following output section:

```
$2042 JSR $2000
      LDX #500
      STX $FC
```

Now check for end-of-file. If it's not set, repeat the whole procedure.

```
$2049 LDX $FD
      BEQ $2012
```

If we're at the end of the file, we check the flag one more time. If it's set, send a return.

```
$204D LDA #50D
      LDX $FC
      BEQ $2056
      JSR $2000
```

All done.

```
$2056 RTS
```

See program listing on page 85. ■

Roger M. Pingleton, Jr.

For a nice change of pace, take a break from the productivity and applications environment with this arcade-style action game for one or more players. This GEOS desk accessory runs on either the 64 or the 128 using GEOS or GEOS128.

"Skeet" is a fast-paced electronic version of the shotgun-and-clay-pigeon skeet shoot, running under GEOS or GEOS128. In Skeet, you try to shoot down flying clay pigeons by quickly moving your mouse or joystick's pointer over the target and clicking or pressing the fire button. You can play Skeet by yourself or with any number of friends.

Getting Started

Since Skeet is written in machine language, you need to enter it with "MLX," the machine language entry program printed elsewhere in this issue. When you run MLX, you're asked for the starting address and ending address of the data you'll be entering. Here are the values to use for Skeet:

Starting address: 0400
Ending address: 111F

Follow the MLX instructions carefully. When you've finished entering the Skeet data, save it to a GEOS-formatted disk, and then run the GEO-Converter program (Program 2) to convert the file to GEOS format.

Now boot GEOS and go to the GEOS menu. You should see Skeet listed as one of the desk accessories. You can click on Skeet in the GEOS menu or double-click on the Skeet icon to begin playing.

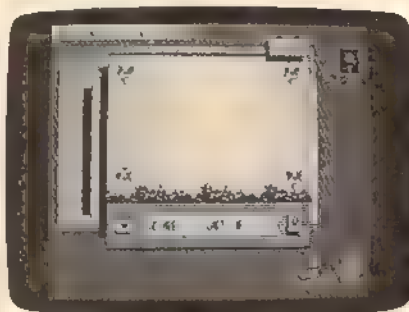
You'll see a box containing Skeet's playing field and four icons shaped like cartoon captions with the word *Pull* in each one. To release a clay pigeon, click on any one of the four pull icons.

When pulled, pigeons begin

their flight from the bottom of the playing field, alternating between left and right, with the first pigeon beginning on the right side. Since the pigeons alternate sides, you can always predict from which side the pigeon will be coming so you can pull from an icon that gives you the best shot.

Make It Count

Once a pull icon has been selected, you have just one shot with which to hit the clay pigeon. You shoot by pressing the fire button on the joystick or clicking the left mouse button. Holding the button down after selecting the icon will waste your one shot, so be sure to release the button after you've pulled.



Pull! It's skeet hunting season in GEOS. Use a joystick or mouse to shoot down as many clay pigeons as you can.

Below the playing field is a box containing your score and the number of pigeons pulled so far. Each time you shoot, *score* flashes.

Above the playing field and to its right is a box marked *options*. Clicking this box lets you select the number of pigeons to use for each game (10-100, with 20 being the default) and the speed at which the pigeons fly (fast, medium, or slow, with medium being the default). These options can be changed before, during, or after any game, with one exception: If you select an option to use fewer pigeons than have already been pulled, your change will be ignored.

When a game is over, your percentage of hits is displayed in the middle of the playing field and your pointer is placed on and restricted to the reset box—the box with the *R* in it. After you've clicked on the reset box, the game resets and you can either play again or click on the close icon in the lower left corner of the playing field to return to GEOS.

Tips And Traps

Shooting from the icon closest to a clay pigeon's launch site can be easy if you fire at the pigeon's lowest point. This strategy can be difficult, however, if you decide to follow the pigeon up and shoot at it later.

Different input devices can dramatically change the play of the game. The proportional mouse helps the pointer's mobility. Some shots that are impossible with the joystick are easy with the mouse or some other proportional input device.

If you're using a joystick, you'll want to keep the pointer moving at the maximum velocity. You can do this by constantly moving the pointer around the screen and selecting the icons while in motion or only stopping briefly to select them. Stopping to look at the number of shots fired (the *OUT OF* number on the screen) can bring down the velocity of the pointer or put you out of sync with the speed of the pigeons.

You can change the minimum and maximum velocities of the pointer, as well as its acceleration, with the *GEOS Preference Manager*, providing a parent application doesn't alter these values. Skeet changes the shape of the pointer from an arrow (the default) to a gun sight when it enters the playing field.

If you make an amazing shot, *GREAT SHOT!* is displayed on the screen. This happens in two circumstances:

- When you pull from an upper icon and hit the pigeon when it is at its largest

• When you pull from a lower icon and hit the pigeon on its descent

It's difficult to hit the pigeon while the pointer is in motion. While neither of these shots adds more than one hit to the player's score, they make for a greater display of marksmanship.

Skeet can be played with several variations. For practice, try selecting a goal of 100 pigeons. (An asterisk in the options menu always lets you know how many have been chosen. Each player (in multiple-player games) can choose an icon from which to pull. If one player is better than another, the weaker player can be given a handicap by being allowed to choose a slower speed for the pigeon or more shots in which to beat the percentage score of the better player.

The positions of the icons allow you to create your own game variations. One variation, "Around the World," can be played by shooting five shots from each icon and deciding the winner based on the most pigeons hit out of 20. Another game, "Horse," can be played by shooting from one icon at a set speed. You can also tally the greatest number of hits in a row from any particular pull icon.

Program Notes

There are several noteworthy programming techniques used in Skeet. Since Skeet is a desk accessory, special menu handling is required in order to keep from destroying any application data. When Skeet is initialized, it saves the portion of the background screen under the area where the menu will unfold. Then it imprints that same area from the foreground to the background. Thus, when the menu is rolled up, the GEOS Kernal can simply restore the background screen. Before leaving the game, Skeet restores the background screen to its original state.

Another technique is found in Skeet's bush-drawing subroutine. A bitmap pattern is defined for the bushes at the bottom of the screen using the GEOS compaction scheme. This pattern repeats three times, taking up one-third less room in memory than conventional bit-mapped data. Studying the screen will show where it repeats.

See program listings on page 81. ■

power BASIC

Fast Hi-Res Screen Dump

Jack Reno

This hi-res screen dump program is the fastest and most versatile we've ever published. It works on the Commodore 64, 128, Plus/4, and 16 with Commodore 1525, MPS-801, MPS-803, MPS-1000, MPS-1200, and compatible printers.

One of the strongest features of Commodore computers is graphics. Of course, the problem with computer graphics is that the picture disappears from the screen when you turn the power off. If you have a Commodore 1525 or compatible printer, you can transfer your 128, 64, Plus/4 or 16 hi-res screens to paper at lightning speed with "Fast Hi-Res Screen Dump." [Ed. Note: Our test results were a speedy 1 minute, 25 seconds per screen dump.]

Typing It In

Hi-Res Dump is in the form of a BASIC loader. If you plan to use the program on a 128, be sure to use 128 mode when you type the program in. This will ensure that all the 128-specific keywords are properly tokenized.

Type in the program. Now you must tell the program where your hi-res screen is located. To do this, adjust the value of the variable SL in line 30. For the 128, Plus/4, or 16, use the value 8192. This is where the hi-res screen is located when you use BASIC's GRAPHIC command. If you're using a 64, enter the starting address of your hi-res screen. Many hi-res drawing programs on the 64 use the area starting at 24576 (\$6000). If you have trouble locating the bitmap, just remember that it starts at an address that is an even multiple of 8192 (\$2000).

Now save the program to disk. When you're ready to print a picture on the 64 or 128, load and run the program. (If you are using a Plus/4 or 16, type POKE 56,23:

POKE 5,0:CLR and then load and run the program.) You'll be asked where you would like the machine language program to be POKED into memory. Depending on which machine you're using, try one of these values:

Commodore 64:	49152
Commodore 128:	3072
Plus/4 or 16:	5888

After the machine language program has been POKED into memory, type NEW and then load the hi-res screen into memory. This can usually be done with a statement of the form LOAD"SCREEN",8,1. On the 128, use BLOAD"SCREEN",B0,P8192. Replace SCREEN with the filename you used when you saved the picture.

To send the picture to the printer, type SYS starting address, where starting address is the value you entered above. For example, SYS 49152 would be the correct statement to enter on the 64.

After your picture is printed, your printer remains in graphics mode. Turn it off and then back on to reset it.

See program listing on page 80. ■

COMPUTE!'s Gazette is looking for utilities, games, applications, educational programs, and tutorial articles. If you've created a program that you think other readers might enjoy or find useful, send it, on tape or disk, to:

Submissions Reviewer
COMPUTE! Publications
P.O. Box 5406
Greensboro, NC 27403

Please enclose an SASE if you wish to have the materials returned. Articles are reviewed within four weeks of submission.

So you can code circles around the pros, eh? Well, here's your chance to prove it. It's the GEOS Programming Contest. And all it takes to win is a Commodore and your skill at programming under GEOS to win in any four categories and walk away with all kinds of prizes.

Including a check for \$1,000.
Just send us the GEOS-based program

- applications from Berkeley Softworks
- Commodore peripherals: 1670 1200 Baud Modem, 1351 Mouse and 1764 or 1750 RAM Expansion Module
- Six month subscription to Q-Link, the telecommunications service and Q-Link's Public Domain Software Library from Quantum Computer Services
- Twelve month subscription to Compute!'s

6. Judging will be performed by the staff of Compute!'s Gazette Magazine. The decisions of the judges are final in all respects. This includes decisions regarding creativity, similarity among entries and general suitability.

7. Entries become the property of Berkeley Softworks, which reserves the right to adapt, use or publish all entries received. Entries may become part of a "shareware" library to be distributed by Berkeley Softworks, Compute!'s Gazette and Quantum Computer Services. As part of each

YOU WRITE THE PROGRAM, WE'LL WRITE THE CHECKS.

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There are four categories, each with an Applications¹ and Desk Accessories² winner. Which means that there are eight first prizes. Eight second prizes. And eight thirds.

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And that's only where the bucks start. Because if your program makes it into a GEOS Shareware Library, all kinds of satisfied users may be writing you checks.

So boot up and get down to pumping out your most professional GEOS program. Then send it in with the information required below. Who knows? We could be sending a check right back to you.

1. Applications are identified by the GEOS Application File Type, are entered from and exit to the desktop and conform to the GEOS user interface.

2. Desk Accessories are defined as programs which are less complex than applications, are identified by the GEOS Desk Accessory File Type, may be entered and pop-up within any application and upon exiting return the application to its prior state.

Categories

ENTERTAINMENT — Includes entertainment and games. For example, a Chess game (Applications Division) or a trivia game (Desk Accessories Division).

EDUCATION — Primarily educational and instructional. For example, a world geography program (Applications Division) or a flash card program (Desk Accessories Division).

PRODUCTIVITY — Designs that improve personal productivity. Examples include an "outline processor" (Applications Division) or a scientific or financial calculator (Desk Accessories Division).

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- Complete library of C64 or C128 GEOS

The GEOS Programming Contest.

Gazette magazine

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- Announcement in Compute!'s Gazette Magazine
- Complete library of C64 or C128 GEOS applications from Berkeley Softworks
- Commodore peripherals: 1670 1200 Baud Modem and your choice of a 1764 or 1750 RAM Expansion Module or 1351 Mouse
- Three month subscription to Q-Link, the telecommunications service and Q-Link's Public Domain Software Library from Quantum Computer Services
- Twelve month subscription to Compute!'s Gazette magazine

Eight Third Prizes!

- Announcement in Compute!'s Gazette Magazine
- Your choice of any five C64 or C128 GEOS applications from Berkeley Softworks
- Commodore peripherals: 1670 1200 Baud Modem and your choice of a 1764 or 1750 RAM Expansion Module or 1351 Mouse
- Three month subscription to Q-Link, the telecommunications service and Q-Link's Public Domain Software Library from Quantum Computer Services
- Twelve month subscription to Compute!'s Gazette magazine

Official Rules

1. Employees of Berkeley Softworks, Quantum Computer Services, Laser Direct, Compute!'s Gazette Magazine, their advertising and promotional agencies and their immediate families are not eligible to enter the contest.

2. Each entry must be your original work, previously unpublished in any form. All the programs accepted will be required to affirm this in writing.

3. Contestants may enter multiple categories, but may only submit one entry per category per division (e.g., one entry in the Entertainment category Applications Division, and one entry in the Entertainment Desk Accessories Division). Regardless of the number of categories you enter, you will only be eligible to win one prize.

4. Deadline for entries is August 31, 1988. Mail entries to Compute!'s Gazette, P.O. Box 5406, Greensboro, NC, 27403.
Attn: GEOS Programming Contest.

5. Acceptance of an entry shall not create any implication that the entry has been received and reviewed by Berkeley Softworks or has been used in any way in product development.

submission, contestants should include in the program their name, address and a "user fee" amount for satisfied users to send a discretionary payment.

8. Entries may be written in any programming language but must be a GEOS based program supporting the GEOS file structure and be executable from the GEOS desktop or a GEOS application. Whichever language is chosen, the code must be a self-standing program that can be run by someone who does not own the language. We must be able to legally distribute the program without incurring licensing fees or any other obligations to the maker of the language.

9. Entries must be submitted on 5.25" floppy disks in 1541 1571 format. The following should be clearly marked on both the printout and the disk:

- A. Contestant's name, address and phone number.
- B. Category and division for the entry.
- C. Intended use for the program.

10. Entries must be accompanied by a description which explains how to use the program and what it does.

11. This contest is void where prohibited by law. All federal, state and local taxes are the sole responsibility of the winners.

General Conditions

- Entries will be judged on creativity, originality, interface consistency with other GEOS programs and error-free quality of the code.
- Make sure your mailer will protect your disk from damage. Affix sufficient first class postage. Mail your printout, disk and official entry blank to the above address in time to reach Compute!'s Gazette Magazine before the August 31, 1988, deadline.
- Winners will be announced by October 1988.

Sponsored by Berkeley Softworks and Compute!'s Gazette.

PLEASE PRINT

Name _____

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Address _____

City _____

State _____ Zip _____

Age _____

EVERY CONTEST ENTRY MUST INCLUDE THIS

STATEMENT: I warrant that the program presented contains my own original work and that the work has not been submitted for consideration elsewhere, nor has it been previously published in any form. I hereby release, assign and irrevocably warrant that you, your agent, or the sole awarding agency, shall have the right to use, without restriction, in my part, I understand that by entering this contest, my entry becomes the property of Berkeley Softworks and in the event my program is included in a shareware library, I will be required to sign a standard release agreement. If you are under 18, your parent or legal guardian must sign for you.

Signature _____

Berkeley Softworks

The brightest minds are working with Berkeley.

Mob Maker

A Professional-Quality Sprite Editor For The 64

Bruce Thompson

"Mob Maker" is the closest thing we've seen to a perfect sprite editor. It offers many advanced features—and is a must for animators and game designers. For the 64 with disk drive.

Sprite editors for the 64 have been around almost as long as the 64 itself. "Mob Maker," a sprite editor that takes its name from an early term for sprite (movable object block), distills the best features of the most popular sprite editors and adds a few of its own.

If you use "Sprite Magic" (GAZETTE's most popular sprite editor, published in the August 1984 and 1987 issues), you'll find that many of the commands have been retained. You'll also be happy to discover that Mob Maker is file-compatible with Sprite Magic.

But Mob Maker goes beyond Sprite Magic. It lets you view eight sprite definitions at a time—a great boon to animators. The sprite definitions can be moved around to help you design the combined sprites that are often used in commercial games. Mob Maker also features advanced data-block control. For instance, you can easily copy a group of sprite definitions from one area to another.

This is one tool that game designers won't want to be without.

Typing It In

Mob Maker is written in machine language, so you'll need to enter it with "MLX," the machine language entry program located elsewhere in this issue. When MLX prompts you

for starting and ending addresses, respond with the following values:

Starting address: 0801
Ending address: 1D10

When you've finished entering the program, be sure to save a copy to disk before leaving MLX.

Although Mob Maker is written in machine language, it can be loaded and run just like a BASIC program. When you're ready to use Mob Maker, plug a joystick into port 2, load the program, and type RUN. You'll see the Mob Maker editing screen (see photos).

Mob Maker does not clear out the sprite definition area, so you will probably see garbage on the editing grid. Press SHIFT-CLR/HOME to clear out the sprite.

Your First Sprite

At the top of the screen you'll see eight sprites. When Mob Maker is first run, all eight sprites use sprite definition number 16. The first sprite (sprite 0) is the active sprite. The active sprite's definition number blinks to show you that it is active.

You'll notice that each sprite is in a different color. These are the computer's default colors for its eight sprites. We'll discuss color in more detail below.

Now let's get to work. If you haven't done so yet, press



"Mob Maker," is a sprite editor packed with advanced features. Above, all eight sprites show the same image, a basketball.



A second sprite has been designed—this one with arms, legs, and a face.

SHIFT-CLR/HOME to clear the grid. The drawing grid turns blue and sprite definition block 16 is cleared. The flashing square at the top left corner of the grid is the cursor. Use the joystick to move the cursor around the grid. Note that the cursor wraps around the edges when you move off of the grid.

Press the fire button to plot a point in the grid. You should see the point appear in each of the eight

sprites. You can draw continuous lines by holding down the fire button while moving the joystick. In order to erase a pixel or a line, press the 1 key and draw. Turn the pen back on by pressing 3.

Draw a shape (perhaps the first letter of your name). You can use this shape to test Mob Maker's commands.

Mirroring And Moving

Press SHIFT-F. This key mirrors the sprite horizontally. The F key flips the sprite upside down. Now try pressing the left- and right-cursor keys to scroll the sprite one pixel at a time. The up- and down-cursor keys scroll the image vertically.

Loading, Saving, And DATA Statements

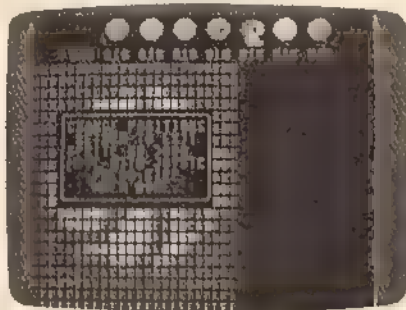
After you've drawn all the sprites you need, save them by pressing SHIFT-S. A window opens with a prompt that asks for the starting and ending page numbers for the data you want to save. The joystick or the cursor keys can be used to select numbers. Press the space bar to enter a number. Next, you'll be prompted for a filename. Be sure not to use quotation marks in the filename. If you decide not to save your sprites, press RETURN to leave the window.

Once you have saved your file, you can load it again by pressing SHIFT-L. You'll see the "NAME/RETURN=EXIT" prompt. Type in the filename (again, omitting the quotation marks), and then press RETURN. If you include the quotation marks or type in the name of a nonexistent file, the red busy light on the drive will flash and the program will return you to the screen as it was before the attempted LOAD. If you simply press the RETURN key without typing anything, the window disappears. If you forget a filename or just want to examine the files on the disk, press SHIFT-4(\$\$) to see the directory. Press any key to scroll through the directory; then press RETURN to close the directory window.

In order to be compatible with SPRITE MAGIC, all data will load into the sprite editor starting at page 16. Be sure to move or save any shapes defined in this area.

BASIC DATA statements can be created and saved to disk by

pressing SHIFT-D. The same number-entry system (using the cursor, joystick, and space bar) is used in the SHIFT-D command. You'll probably have to renumber your DATA statements in order to merge them with your BASIC program, since they start at line 1 and increment by 1. An easy way to do this is with "MetaBASIC," GAZETTE's most popular programming aid, published in the April 1985 and February 1987 (enhanced version) issues.



"Mob Maker" lets you move the sprites anywhere on the screen. Here, two sprites are overlapped to create a two color hi-res human basketball (see third sprite from right at top of screen).

The Sprite Pointer

After you've loaded the newly created and saved file, the eight displays across the top of the screen should all be pointing at sprite page number 16. To change the sprite definition of the active sprite, use the + and - keys. When you hold down the SHIFT key, all eight sprite pointers (not just the active ones) are incremented or decremented.

Selecting Sprites

The active sprite can be changed at any time with the function keys. Press f1 to select sprite 0, f2 for sprite 1, and so on. When you work on animated sprites, you'll probably want to see how a sequence of sprites look together. To do this, use the function keys and the + and - keys to change the pointers to a sequence. For instance, make sprite 0 point to definition 16, sprite 1 point to 17, sprite 2 to 18, and so on.

Cursor Velocity

Press V to change the cursor speed (velocity). A window will open and ask for the new speed, which can range from 1 to 9. The fastest speed is 1, and the slowest is 9. The cursor velocity affects the drawing speed and also the speed at which the def-

initions change when you hold down the + or - keys. This feature lets you preview animation at various speeds with the + and - keys. To return to normal speed, change the velocity to 5, the default.

Moving The Sprites

The sprites displayed across the top of the screen can be moved. Begin by pressing Z. Next, enter the number of the sprite you wish to move. (As usual, pressing RETURN will allow you to exit and close the window without changing anything). To confirm your selection, press the space bar or the fire button. Use the joystick to move the sprite wherever you like. Press the fire button to enter the sprite's new position.

After you've worked with Mob Maker a while, you'll find several reasons for moving sprites. By moving one on top of another, you can draw hi-res, two-color sprites. By moving sprites next to or above each other, you can create the giant sprites used in many commercial games.

Expand Mode

Press X to expand the active sprite horizontally. Press Y to expand it vertically. Press the key again to return the sprite to its normal size. By holding down the SHIFT key and pressing either X or Y, you can change the size of all the sprites.

Killing The Grid

At times, the drawing grid can be distracting. Press SHIFT-W to "wipe" the grid. Press W to bring it back.

Using The Buffer

Working with animation effects often requires designing a series of frames, with each successive frame changing the position of the image slightly in order to create the illusion of movement. To save a frame to the buffer, press the I (Into Buffer) key. The buffer holds one page of sprite data. To practice using the buffer, set one of the sprites to 16 with the + or - key. Then press I. A window will flash open briefly with the message CURRENT DATA SAVED. Advance the pointer to the next sprite pointer and press O (Out of Buffer). This will replace the contents of the current page number with the shape in the buffer. This new image can be edited

to become the next frame in the animation sequence, and then be stored in the buffer, with the process repeated to create the effect of movement.

Working With Color

There are two sprite modes: hi-res and multicolor. Let's start with the hi-res mode, the mode we have been in up to this point. To change the color of one of the sprites, press the C (Color) key. A window opens that reads:

```
CHANGE COLOR OF
1=BACKGROUND
3=SPRITE COLOR
RETURN = EXIT
```

Press the 1 key, and you'll be prompted to enter a color key. You can select one of the 16 available colors, entering the new color in the usual way, by pressing either the COMMODORE key or the CONTROL key together with one of color keys at the top of the keyboard. Of course, if you happen to select a background color that is the same as the foreground color, the image on the grid will disappear. Press C again, this time selecting 3 at the prompt. Enter a new pen color. If the screen color clashes with some of your selections, you can change it by pressing S (Screen Color) until you get a pleasing color.

Press M to enter multicolor mode. Then either load one of your saved sprites or draw a new shape. This shape will appear in multicolor. Pressing SHIFT-M will set all eight sprites to multicolor. Notice that in multicolor mode the pixels along the x-axis expand to twice their normal size. Multicolor mode is a tradeoff; you trade half the resolution for four times as many colors. Sprite Magic users will be happy to note that Mob Maker performs all operations correctly in multicolor mode—even the horizontal flip.

Press the C key to experiment with changing colors. A window offering the following choices will open:

```
CHANGE COLOR OF
1=BACKGROUND
2=M.C.0. [01]
3=SPRITE COLOR
4=M.C.1 [11]
RETURN = EXIT
```

The background option works the same way that it does in the hi-res mode. Pressing 3, the sprite color

Mob Maker Quick Reference

C	color assignment
D	shifts sprite down one pixel
DEL	deletes current sprite
HOME	moves cursor to upper right of design grid
I	stores current sprite in buffer (buffer holds one sprite)
L	shifts sprite one pixel to left
M	toggles multicolor
O	gets sprite from buffer
Q	quit—exit to BASIC
R	shifts sprite one pixel to right
S	advances screen color
U	shifts sprite up one pixel
F	toggles mirroring (left/right flip)
f1-f8	select sprites 0 to 7
V	sets display and cursor movement velocity
W	brings back grid
X	toggles x expand
Y	toggles y expand
Z	allows sprite display (0 to 7) to be repositioned anywhere on the screen
+	increments sprite pointer
-	decrements sprite pointer
\$	disk directory
SHIFT-CLR/HOME	clears out current sprite
SHIFT-F	toggles vertical flip
SHIFT-R	reverses on and off bits
SHIFT-+	increments all sprite pointers
SHIFT-—	decrements all sprite pointers
SHIFT-W	wipes out grid for clear view of sprites
SHIFT-X	toggles x expand all
SHIFT-Y	toggles y expand all
SHIFT-M	toggles all multicolor on
SHIFT-A	loads sprite data (does nothing if file not found)
SHIFT-S	saves sprite data in a binary file
SHIFT-D	makes DATA statements and saves them to disk
SHIFT-INST	inserts blank data block at current sprite number
SHIFT-C	copies sprites to other locations

option, affects color changes for the current sprite only. Make some color changes using this option. Notice that only the current sprite is affected by the changes you made. Now press C again and select option 2 or 4 when the window appears. Note that when you change colors using these options the color changes in all of the eight sprites. Both options 2 and 4 work in this manner. This means that in the multicolor mode each sprite can have four colors—one is unique, one is the background color (transparent), and the other two are shared by all eight sprites.

Moving Data Blocks

You have already used the Clear command (SHIFT-CLR/HOME). The Delete command works somewhat differently. If you press the DEL key, the current page of sprite data is erased and the rest of the sprite pages are renumbered to fill the gap left by the deleted sprite. This can be useful when you want to remove a sprite from an animation sequence.

The Insert command (SHIFT-INST) inserts a blank data block at the current sprite number. The other sprites are renumbered and move up by 1. (Sprite 255 is lost.)

The Copy command (SHIFT-C) copies a range of sprites to other locations. A window opens to prompt you for the starting page number, the ending page number, and the number of the page to which the data is moved. Numbers can be entered with the cursor keys or the joystick. The left-/right-cursor key increments numbers by 10, while the up/down key increments by 1. Press the space bar to enter the selected numbers.

Quitting The Editor

Pressing Q will allow you to quit and exit to BASIC. You can reenter Mob Maker from BASIC by typing RUN again. However, if you have loaded a BASIC program or a DIRECTORY while in BASIC you must reenter by typing SYS 2106.

See program listing on page 83. ■

1541 Speed And Alignment Tester

Ross Ouwinga

Your disk drive is probably the most important peripheral you own. Since it contains precision mechanical parts, it's also the most likely to cause problems. "1541 Speed And Alignment Tester" helps you track down those problems. For the Commodore 64 and 1541 drive.

For most computer users, a disk drive is a critical component of the system—it's the primary means for loading and saving programs. Without it, most types of computing would be impractical, if not impossible.

When your 1541 disk drive malfunctions, "1541 Speed And Alignment Tester" can help you discover just what the problem is.

1541 Tester analyzes the most critical functions of the disk drive and provides you with important information via display on your monitor. With just a glance, you'll see how fast your drive is running, how far off the alignment is, and how well it reads each track of a disk. It even tells you how well it reads between tracks. Once this information is displayed in front of you, you should have no trouble deciding if a problem is serious and requires a trip to the repair shop. Knowing what's wrong with your drive can save you a lot of time, trouble, and money.

Common Problems

The 1541 is a relatively reliable disk drive. Its mechanism is rugged and can tolerate a considerable amount of abuse. However, nothing is perfect, and there are times when something in the 1541 fails. Typical

problems can be caused by a corrupted disk, a broken or maladjusted mechanism, or faulty electronics. All of these can cause intermittent load and save problems. In extreme cases, the drive will not function at all.

If your drive does not operate at all, turn the drive off and then back on. Next, check the power cord—both at the outlet and at the back of the disk drive—to make sure it's plugged in tightly. If this fails, check for a blown fuse in the back of the drive. Replace the fuse, if necessary, with one of the very same rating.

If none of these steps solves your problem, something may be wrong with the internal electronics of the drive. If when the power is turned on, the red light comes on and stays on or begins flashing, it is almost certain to be a serious electronics problem. Anytime the problem involves internal electronics, you'll have to take it to a repair shop.

Distinguishing other problems usually is not quite as easy. In most situations, a problem results in the familiar read error symptoms—the red light flickers and the drive makes a clattering noise. The program may take longer than usual to read or save, or the disk drive will abort the procedure altogether and start flashing the red light to indicate

an error has occurred. You can easily find out what this error is by running the following short program:

```
10 OPEN 15,15:INPUT #15,A,B$,C,D:
CLOSE:PRINT A;B$;C;D:END
```

The error is convenient to know at times, but generally it is not sufficient to let you know the real source of the problem. These types of errors may occur if a disk is corrupted, the drive is rotating the disk at the wrong speed, the head isn't aligned properly, or even if the drive is operating in an electronically "noisy" environment. Since these problems all have nearly identical symptoms, a program like 1541 Tester is necessary for providing you with additional information to help pinpoint the problem.

Typing It In

Since the program is written entirely in machine language, type it in with "MLX," the machine language entry program found elsewhere in this issue. After loading and running MLX, answer the prompts for starting and ending addresses with the following:

```
Starting Address: 0801
Ending Address: 13D0
```

Type in Speed And Alignment Tester and save it to disk. If you have a tape drive, you should also save a copy on tape. This allows you to load the program if your disk drive is not functioning well enough to load it from disk.

To load the program from disk, type `LOAD "filename",8`. If you're loading from tape, type `LOAD "file-`

name". When you're ready to run the program, type RUN.

The title screen appears, followed by a short delay while a program is being written to the disk drive's RAM. When this is done, the menu is displayed and you're prompted to select either the speed test or alignment test option.

Up To Speed

The speed test checks how fast the disk is spinning when the disk drive is reading and writing. The speed can fluctuate somewhat without causing any problems. However, there are limits, and some programs—particularly those with copy-protection—are more sensitive to speed variation than are others. Normally, a disk should rotate at about 300 RPM (Rotations Per Minute). This should not vary by much more than one or two RPM. If it does, a read or write error may result.

To check your drive's speed, load and run the program. When the main menu appears, press the 1 key. You'll be prompted to insert a blank disk. This disk may be formatted or unformatted, but make sure the write-protect notch is uncovered. The speed test writes to the disk, but it uses an area of the disk that normally isn't used by the 1541. If you have data on the disk, it won't be destroyed; however, to be absolutely safe, use a disk that has nothing important on it.

After inserting a disk, press any key to continue. The speed data screen appears. After some calculations are completed, the speed is displayed along with the difference between it and the ideal speed of 300 RPM. The difference also includes a plus (+) sign and a minus (-) sign. A plus indicates the disk is spinning too fast and a minus indicates it is spinning too slowly. If the speed is within tolerance, it's displayed in green. If it's a little out of tolerance, it's shown in yellow. This indicates only a slight problem. If the speed is far enough out of tolerance, it's shown in red.

If the speed is in the red, your drive can still save and load programs without error, but you may have difficulty reading disks formatted on another drive. For this reason, it's recommended that you have your disk drive adjusted if it consistently runs in the red.

The speed is continuously recalculated and displayed, and it isn't unusual for the speed to fluctuate somewhat as the disk drive runs. This is nothing to worry about—some disk drives are better than others, and even the disks themselves cause some variance in speed, depending on the amount of friction they produce. If the disk drive's speed is normally good, but a certain disk causes the speed to drop out of tolerance, that particular disk should not be used. Also, the speed may vary if the drive belt inside the disk drive is slipping. This is not uncommon, especially on older or well-used disk drives. If this is the case, have the belt replaced.

To stop the speed test, press any key. It may be necessary to press a key more than once to stop the program since the program communicates constantly with the disk drive and may miss some key presses.

The Line Up

To begin the alignment test, press option 2 when the main menu is displayed. You're prompted to insert an alignment test disk, and then a new menu of options is listed.

The disk used for an alignment disk may be any formatted disk. For accurate alignment testing, it's important that the disk be formatted on a disk drive that has near-perfect alignment. The closer the alignment disk is to true alignment, the more accurate the test. A commercially produced disk (such as COMPUTE!'s Gazette Disk) is ideal. Do not use a copy-protected disk; the alignment test program does not write to the disk, so it isn't likely that any of the programs on the disk will be altered. However, if any of the programs on the disk are important, make a backup of the them before you use the disk with the alignment test program.

After the alignment disk is inserted into the disk drive, the alignment test is started by pressing the space bar. You should see a data screen with two sets of four columns. The columns are labeled "Track Being Read," "Track Actually Read," "On Track Readability," and "Between Track Readability." As the program runs, the data appears under these headings one track at a time.

The first column is labeled

Track Being Read. The data in this column shows you the number of the track that's being tested by the program. It always begins with track 1 and ends with track 35. This is the standard 1541 disk format and doesn't change, regardless of what is actually on the disk and whether or not the disk drive is in alignment.

Before the data appears for track 1, the program goes through a rather involved procedure to determine the position of the read head. It then moves the head down, past track 1 and against the head stop. If the program is successful in figuring the position of the head, there should be a light "click" sound when the head hits the stop. If it's unable to figure the head position, a little extra head banging may be heard. This is a last resort for the program and is very unusual, but it may occur if the disk drive is severely out of alignment or if you accidentally used an unformatted disk.

The second column is labeled *Actual Track Read*. This is the number of the track that is actually under the read head. There is data on each track of a formatted disk that indicates which track is being read. The alignment program tries to read this data and displays the track number in column 2. Track 1 is the first track that should be read since it's the track that should be under the read head when it's against the stop. For every track, the number that appears in column 2 should be the same as that in column 1. If the numbers are the same, that number appears on the screen in green, indicating that the correct track was read. If the track number read off the disk is not the same as that in column 1, the number is displayed in red. Usually, the numbers in column 2 are all green or all red. It's unlikely that both red and green numbers will be scattered throughout the column.

An incorrectly adjusted head stop is usually the culprit when the track numbers in column 1 do not match those in column 2. The difference between the numbers in columns 1 and 2 tells you how far the stop is out of adjustment. If the difference is 1, the head stop is off adjustment by one track. If the difference is 2, it's off by two tracks, and so on. You can also tell in which direction the head stop is out

of adjustment. If the numbers in column 2 are higher than those in column 1, the head stop is too high and the head cannot move down far enough. In this case, you would never be able to load programs that are saved on the lower tracks. The more common situation is when the numbers in column 2 are less than those in column 1. In this case, the head is allowed to move down too far. This is really no problem when using disks that were properly formatted, because the disk drive is able move the head into position to read all the tracks. Even if the disks are formatted on a disk drive with a head stop adjustment problem, there will be no problem reading all tracks on the disk as long as the disk is used with the same disk drive. A problem arises when the disk is used in a drive that does have a properly adjusted head stop. It will not be able to read the tracks that were formatted too far down on the disk.

Without an alignment tester, a head stop adjustment problem is not easy to recognize. It only shows up when using disks on more than one disk drive, or when the disk starts to fill up with programs. No errors are encountered if the disk isn't very full—programs are saved on the disk beginning at the middle tracks and then they work their way out to either end. Even when the disk drive encounters an error and bangs the head against the stop in an effort to correct the error, as long as the head is able to align itself with any track, the drive keeps working. It's nice that the 1541 is capable of adjusting itself, but it's difficult to know that a head stop adjustment has occurred unless you're using a special test program like this one. Once the problem is known to exist, it's a good idea to have it fixed to minimize the chance of running into a serious problem in the future.

The third column is labeled *On Track Readability*. The data displayed in this column is the most important for determining whether or not the disk drive has an alignment problem. Just as the heading suggests, this is an indication of how well the disk drive is able to read data off the disk for each track. The alignment program attempts to read at least 17 header blocks of

data on the track. If it's able to read each header correctly on the first attempt, the readability is 100 percent, which is displayed in green. This is the way it should be for every track if the disk drive is properly aligned.

If it takes more than one attempt to read any of the headers, the number that appears in column 3 will be something less than 100 percent. If it's between the range of 94 and 99 percent, it's displayed in yellow. This means all the headers were eventually read properly, but there was some difficulty. If the number is less than 94 percent, it's shown in red. This indicates that there was difficulty reading one or more headers, and possibly, the disk drive wasn't able to read some headers at all. A well-aligned disk drive should not have any trouble reading all tracks at 100 percent. If this is not the case, try another alignment disk. If the results are similar, there's probably an alignment problem with your disk drive. Before having it realigned, however, move it to a different location, as far as possible from your TV set, monitor, printer, computer, or any other electronic device that might be near by. Electronic interference is probably more common than true alignment problems, and it produces the exact symptoms. If moving the drive makes no difference, you'll need to take your disk drive into the shop for repair.

The fourth column is labeled *Between Track Readability*. This is very similar to the information given in the third column, except the read head is actually positioned between the tracks. Ideally, the drive shouldn't be able to read any data and the readability should always come up 0 percent. In reality, some of the data from the surrounding tracks bleeds over to the area between the tracks. Even though the disk drive is capable of reading some data between tracks, it would make sense that it would have the most difficulty reading consistent data when it is exactly midway between the two tracks. When it's close to the middle, the numbers should be low; when the head is closer to either of the tracks, the numbers should be higher. In practice, this is true enough to give some useful information, but due to tolerances in the entire mechanism

and in the disk itself, these numbers cannot be considered absolute and should be used for reference only.

In column 4, the numbers change colors at different points than they do in column 3. If the number is 0 percent, the number is displayed in green. This is the ideal condition when reading between tracks. If the number is in the range 1–80 percent, it's displayed in yellow—numbers most commonly fall within this range. If the number is 81–100 percent, the number is made red. Red numbers are less frequent than yellow numbers, but they do appear even on disk drives that work very well. The alignment is best if there are at least a few green numbers. There may be problems if a lot of numbers are red, but don't be concerned if the numbers in the third column are consistently high (green).

You may also notice that some or all of the numbers in the fourth column are followed by a plus or a minus sign. The program counts how many times it reads data from the lower track and how many times it reads data from the upper track. It then displays a "+" or "-" to indicate which track was read more often, and it lets you know which track it is closer to. If a minus sign is displayed, the lower track appears closer. If a plus sign is displayed, the high track appears closer. If the sign is consistent for all the tracks, the head is likely to be on the high or low side, depending on which sign is most dominant. If there is a somewhat equal spattering of plus signs and minus signs, the head is probably pretty close to being midway between the two tracks. If there is no symbol, either both tracks appeared equally close or the program was unable to read enough information off the disk to make the calculation.

Even though the alignment test provides a considerable amount of information on the screen, it isn't difficult to use, especially if you're using a color monitor. If all the numbers in columns 2 and 3 are green, the alignment is good. If you're using a black-and-white monitor, columns 1 and 2 should be identical, and column 3 should be filled entirely with the number 100 for proper alignment. The disk drive requires repair if col-

umns 1 and 2 don't match, or if column 3 has any numbers below 94 percent. However, before sending the disk drive to be fixed, make sure you try more than one alignment test disk to make sure the disk itself has not become defective.

Operating The Program

It's possible to stop the alignment program and get back to the menu at any time by pressing any key. It may be necessary to press it several times since the computer is constantly communicating with the disk drive and will, at times, ignore the keyboard.

The program stops testing when it finishes testing track 35. Press any key to cause the menu to appear. It's possible to make the testing run continuously by pressing selection A when the menu appears. With this option, the program automatically clears the screen after it reaches track 35 and begins again at track 1. It's necessary to press a key (possibly more than once) to get the program to stop.

Option 1 of the menu causes the read/write head to move to

where track 1 should be. The program then reads the track number off the disk, displays it, and stops. This option is included for those who may use this program to adjust the head stop themselves. This adjustment requires disassembly of the disk drive and includes a significant danger of electrical shock and should not be attempted by anyone not qualified to do so.

To return to the main menu from the alignment test menu, press the f1 key. It's recommended that you return to the main menu and press the Q key to quit the program. This resets and initializes the disk drive to make sure it's ready for the next program.

It's possible to test the alignment of a friend's disk drive without actually having that person's disk drive available. Have the friend format a disk on his or her drive, and then use that disk as the alignment test disk. If the alignment checks out, it's likely the disk drive is properly aligned. If the disk does poorly, it would be wise to run the alignment test program directly on the suspected disk drive before

making a decision to have it fixed.

Any disk can be tested for proper formatting, using the alignment test. Just use the disk to be tested in place of the alignment test disk. The data displayed shows you if all tracks are formatted and if they're in the right order. It also shows you, if certain tracks contain errors, whether the readability (column 3) of that track is lower than it should be.

There may be more applications than mentioned in this article. It isn't guaranteed that the program will operate appropriately for any application you dream up, but it does include a number of safeguards to avoid erratic behavior from the disk drive. It's impossible to damage the disk drive by running programs, but it is possible to get it lost. If this is the case, turn the disk drive off and then back on again. Then, type in and run the following short program:

```
10 OPEN15,8,15,"10":CLOSE15:END
```

This initializes the disk drive and repositions the read/write head to its home position.

See program listing on page 88. ■

Make music

With Your 64 or 128!

COMPUTE!'s Music System for the Commodore 64 and 128
 Craig Chamberlain
 ISBN 0-87455-074-2 \$24.95 Book/disk combination only
 274 pages

Sidplayer, the feature-packed, popular music player and editor program, is now more versatile and more impressive than before. Enhanced Sidplayer for the Commodore 128 and 64 includes two new versions—one for the Commodore 128 running in 128 mode and another for the Commodore 64. Take advantage of every feature the SID chip (the sound chip in the 128 and 64) has to offer. Just like the original, Enhanced Sidplayer is easy to learn and use, with many powerful new features. The accompanying disk contains the editor, player programs (including a Singalong program), utilities, and sample music that you can enjoy immediately or change. The new Sidplayer plays any songs created by the original Sidplayer for the Commodore 64.



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128 Math Graphics

Clifton Karnes

If you think math is boring, take a look at the beautiful, symmetrical shapes this program can create on your 128's screen. Using polar geometry and an interesting collection of mathematical functions, "128 Math Graphics" may convince you that math can be fun. A disk drive is required and a color monitor is suggested.

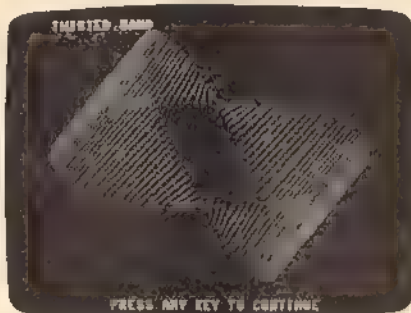
In October 1986, COMPUTE! published "Amiga Math Graphics," and, about a year later, in August 1987, "Math Graphics For Atari ST." The graphics demos were impressive, but both versions were for 16-bit computers with super-high-resolution video. Could math graphics like these be created on an eight-bit computer like the Commodore 128? The answer is *yes*.

The two programs accompanying this article—"128 Math Graphics Demo" (Program 1) and "128 Math Graphics Tool Kit" (Program 2)—show that the 128's graphics capabilities have to be seen to be believed. Program 1 demonstrates seven math graphics, one after another. Program 2—the Tool Kit—allows you to interactively create, alter, load, and save Math Graphics.

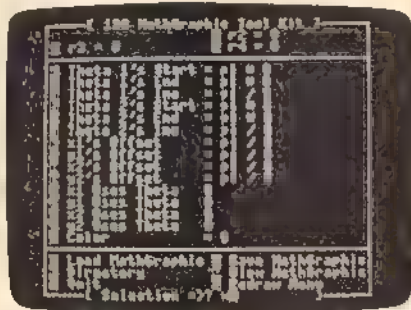
Using The Demo

Since Math Graphics Demo (Program 1) is written entirely in BASIC, type it in, save a copy to disk, set your 128 for 40 columns, and type RUN. The Math Graphics Demo is based on the Amiga and Atari Math Graphics programs, but is customized for the 128. It displays a series of seven graphics on the 128's high-resolution (320 × 200) screen.

The first graphic shape you'll see is a star. This design is followed by a twisted band, a spiral cone, a side spiral cone, spikes, a right oval, and finally, a multilobe. Each graphic uses a different foreground color,



One of the many graphics screens from the demo program (Program 1).



The Tool Kit (Program 2) is a powerful graphics utility that lets you alter, save, and load custom Math Graphic images.

and two are multicolored. If you want to move on to the next graphic before the current one finishes, simply press any key and the demo will begin displaying the next one.

The graphics presented in the demo are interesting and entertaining to watch, but they're just a few examples of what you can create with the 128 Math Graphics Tool Kit (Program 2). The Tool Kit allows

you to experiment with graphic designs. You can change any Math Graphics parameter, load Math Graphics from disk, save your new designs, view the directory, change colors, and more.

Math Graphics Tool Kit

The Tool Kit is a BASIC program, so type it in, save a copy to disk, set your 128 for 40 columns, and type RUN. You'll see a menu of choices marked a-y. To give you an idea of how the Tool Kit works and how to experiment using the menu, the following examples show the way the values are used, with each menu item indicated in *italics*.

```
FOR T1=PI*e TO PI*f STEP PI/g
  FOR T2=PI*h TO PI*i STEP PI/j
    RR=a:TT=o+PI/k:GOSUB
      POLARX x1=POLARX
      RR=b:TT=p+PI/l:GOSUB
        POLARY y1=POLARY
      RR=c:TT=q+PI/m:GOSUB
        POLARX x2=POLARX
      RR=d:TT=r+PI/n:GOSUB
        POLARY y2=POLARY
    NEXT T2
  NEXT T1
POLARX POLARX=RR*COS(TT)+X
  CENTER
POLARY POLARY=RR*SIN(TT)+Y
  CENTER
```

Let's discuss each menu option. a-d determine the size and shape of the graphic. You'll notice in the demonstration program that these numbers change very little from one graphic to another. It can be interesting, though, to alter these values and see how each one affects the printed graphic.

e. The start of the first theta loop—variable T1 in the example above—this value is usually set to 0, and you probably won't need to change it.

f. This is the end of the first theta loop. If the number 2 is chosen, the

graphic is drawn once. Increasing the number causes the graphic to be redrawn, and decreasing it causes the graphic to be incompletely drawn.

g determines the increment of the loop. It's fun to experiment with this value. The smaller the number, the greater the distance between each line in the graphic; the larger the number, the smaller the distance.

h. The start of the second theta loop—T2. A second theta loop is needed for some graphics. If you only need one loop, however, you can set the starting and ending values of either this theta loop or theta loop 1 to 0. Just be sure to place the appropriate values in menu choices **o-r** so that **x1, y1, x2,** and **y2** use the active theta loop.

i. The end of the second theta loop. Like the first loop's end, this determines how much of the graphic is drawn. A value of 2 is good to use here, also.

j. The second theta loop's increment can be changed with option **j**. This is an interesting value to experiment with. As with **g** above, the smaller the number, the larger the distance between lines in the graphic.

k-n are the offsets for **x1, y1, x2,** and **y2**. Altering these values can produce subtle results. If you don't want an offset, any large value—10,000, for example—will effectively eliminate it.

o-r determine whether **x1, y1, x2,** or **y2** use theta 1 or theta 2 values. Changing these values can make a dramatic difference in the graphics. If you're only using one loop, be sure to set these values to that loop's number.

s determines the foreground color of the graphic. The background is preset to black. The colors are Commodore's standard screen colors—black = 1, white = 2, and so on. An easy way to check these colors is to look at the top row of your 128's keyboard. On the front of each key, the top color is the key's number; the bottom color is the key's number plus 8. The Tool Kit reserves the value 0 for something special: multi-color.

t. By pressing **t**, you can load any math graphic you've saved with the Math Graphics Tool Kit Save command. It's usually easier to load an existing graphic and experiment by altering its values than it is to de-

sign a graphic from the beginning. **u** saves the Math Graphic currently on the screen. If you make an error with this command, or with **t** (to load a graphic), don't worry. The program will notify you of your error, and continue.

v views the disk's directory. To return to the menu, press any key.

w is the most important command in the Math Graphics Tool Kit. You press this key to view any graphic whose values are on your menu. While you're looking at the graphic, you can press any key to return to the menu and save, load, or continue to modify your design.

x returns to BASIC.

y redraws the menu. This command can be useful if the menu accidentally scrolls, or becomes corrupted. Pressing **y** will give you a reformatted screen without altering any of the current graphic's values.

Changing A Graphic

To get an idea of how to use the Math Graphics Tool Kit, load and run it (Program 2). Now enter the following values to create a circular graphic:

```
a = 115
b = 85
c = 40
d = 45
e = 0
f = 1
g = 3
h = 0
i = 2
j = 20
k = 10000
l = 10000
m = 10000
n = 10000
o = 2
p = 2
q = 1
r = 1
```

When you've entered these values and have double-checked them, use option **u** to save this graphic with the name *circles*, or something similar.

Now, choose the **w** option to view this math graphic. If you want to return to the menu before the graphic has finished forming, press any key.

Now we're going to alter two values, and cause a dramatic change in the graphic. Change **j** from 20 to 3 and **f** from 1 to 2. Next press **w** to view the new math graphic. Changing these two values has transformed the circle into a star.

See program listings on page 85. ●

bug-swatter

• There is a small bug in "Condensed Font" (January). As listed, the program will print CHECK DATA LINES 230-370 and stop. For all versions, add the line 190 X = 0, and the program will work correctly.

• "SpeedScript Justified" (January) works correctly—however, messages are printed to the screen in the same color as the background. To fix this problem, simply delete line 20. (This problem does not occur when the program is loaded from the Gazette Disk menu.)

Special 1988 Issue Corrections

• **Euchre:** The line following 1255 should be 1260, not 160. The correct checksum should be XQ.

• **SolarPix:** Line 1330 should read
BE 1330 FL=1:IFRIGHTS(KS,1)="R
"THENFL=-1

• **Math Dungeon:** The line following 630 should be 640, not 60. The correct checksum should be BH.

• **Snapshot:** In Program 1, the line following 120 should be 130, not 10. The correct checksum should be FX.

• **Memo Diary:** The line following 1310 should be 1320, not 120. The correct checksum should be BQ.

• **The Construction Set:** The ending address in the typing instructions for Programs 2, 3, and 4 is incorrect as listed. It should be 77FE, not 7803.

• **128 Instant Keywords:** The following changes are necessary for programs 1 and 2 to work correctly.

Program 1:

```
AE 100 PRINT"(CLR)":S=DEC("130
8"):BANK15:FORD=STOS+17
6:READ AS:POKE D,DEC(AS
):NEXT
```

Program 2:

```
HS 30 BANK15:B=PEEK(45)+12+PEE
K(46)*256:PRINT"KEYWORD
{SPACE}VALUE(S) = ";
BD 40 H=PEEK(B):PRINTRIGHTS(HE
XS(H),2);":
```

• **Printer Wedge and SpeedScript:** These two programs are compatible, but disk users must install the wedge at either location 854 or 679. Tape users must install the wedge at location 679 only. Don't press RUN/STOP-RESTORE; it disables the wedge. Follow these steps to use the programs together: First, load and run Printer Wedge. Then assign it a location in memory. Finally, load and run SpeedScript without pressing RUN/STOP-RESTORE. ●

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Periscope

A Disk Editor For The 128

Robert Bixby

Want to get a close-up look at what's on your 128 disk? Need to fix a file? Then try "Periscope," a short but powerful 128-mode disk editor for the 1541, 1571, and 1581 disk drives.

Two weeks ago, my trusty 1541 disk drive bit the dust. It had been through 2½ years of daily service, so I couldn't complain. I had never needed to realign it. In fact, I never even cleaned it. It had traveled hundreds of miles and read hundreds of disks—small wonder that I had begun to think of it as indestructible.

When my 1541 passed away, I got two new drives—a 1571 and a

1581. I also got an unexpected headache.

The Problem

I use three programs almost exclusively: GEOS, SpeedScript, and my assembler. While GEOS performs flawlessly on my new drives, and SpeedScript is as powerful as always, my assembler constantly argues with the 1581. It scrambles

files, places weird entries in the directory, and just generally misbehaves.

I still haven't figured out what the problem is, but along the way I wrote "Periscope," a simple sector reader and editor for the 128 that works with all three Commodore disk drives.

The Solution

In 128 mode, type in and save a copy of Periscope. Because you can seriously damage the information on your disks if you enter the program incorrectly, be sure to use the "Automatic Proofreader" program, found elsewhere in this issue, when you type in the program. When you first use the program, try it on a scratch disk to be sure it's operating properly.

When you are ready to use Periscope, be sure that you are in 40-column mode and then load and run the program. You will be prompted to enter the type of drive you're using. Press A for a 1581, B for a 1571, or C for a 1541.

Finding Your Way Around Commodore Disks

Dale McBane, Assistant Technical Editor

When you type `LOAD"filename",8`, BASIC tells the disk drive that it wants a file called *filename* and then it sits back and waits for the data to arrive. How does DOS (the disk operating system) know where to look for *filename*? To answer this question, let's look at a little background on how Commodore disks are arranged.

Commodore disks can be divided into three basic groups: 5¼-inch single-sided disks, 5¼-inch double-sided disks, and 3½-inch double-sided disks. Of these, the 5¼-inch single-sided format is by far the most common. Single-sided Commodore disks, those formatted on the 1541 or the 1571 in single-sided mode, have 35 concentric tracks numbered from 1 to 35. Track 1 is near the outer edge of the disk and track 35 is near the inner hub. Because the outer tracks are longer, they have more sectors than the inner tracks. Tracks 1-17 have 21 sectors each. Tracks 18-24 have 19 sectors, tracks 25-30 have 18 sectors, and tracks 31-35 have 16 sectors. Sectors are numbered from

0 to $n-1$, where n is the number of sectors in the track. Double-sided disks, those formatted on the 1571 in native mode, are like single-sided disks except that they have an additional set of concentric tracks on the flip side of the disk. Tracks 1-35 are on side 0 and are nearly identical to tracks 1-35 on a single-sided disk. Tracks 36-70 are on side 1 with track 36 near the outer edge and track 70 near the hub. The 3½-inch format of the 1581 is physically very different from either of the 5¼-inch formats, but it's similar logically. As far as the computer is concerned, 3½-inch disks have 80 tracks with 40 sectors per track.

When the disk drive receives the request for a file, it goes to the directory to find out where the file is located. On 5¼-inch disks, the directory is on track 18. On 3½-inch disks, it's on track 40.

The directory contains the information that DOS needs to manage the files on the disk. When DOS needs information about the disk currently in the drive, it goes first to sector 0 of the directory

track. The first two bytes of sector 0 point to the first sector of the directory, usually track 18, sector 1 for 5¼-inch disks or track 40, sector 1 for 3½-inch disks. Each directory sector contains eight directory entries and a pointer to the next directory sector. Each directory entry contains a byte indicating the file type, a pointer to the first sector of the file, the filename, and the number of blocks in the file. For relative files other information, such as a pointer to the first side sector and the record size, is also included. If you use GEOS, then even more information is squeezed into the directory entry.

To find a file, DOS goes to the first directory sector and looks at the filename in each entry to see if it matches the one it's looking for. If the filename matches, DOS follows the pointer to the file itself and begins sending the data to the computer. If it doesn't find the file, DOS follows the pointer to the next directory sector and looks at each entry there. If DOS searches all the directory sectors and still doesn't find the file, it returns a FILE NOT FOUND error.

In order to trace a file, you'll need a sector editor that can display the character representations of the

Next, you'll be prompted for the device number of your drive. To choose the default value of 8, press RETURN. Otherwise, enter the correct device number and then press RETURN.

You should see Periscope's menu:

c—Continue
e—Edit
n—New
b—Back
q—Quit

Since Periscope is best used to trace programs or text files (which are linked by the first two bytes in the sector), Continue is a very useful command. When you press C, Periscope calls up the next sector in the file. When you reach the file's final sector, Continue will have no effect.

The New and Back commands are also used to read sectors. Use the Back command to trace backward from the current sector. This works only when you have used the Continue command to progress through at least two sectors. The

Back command is not able to take you to the sector at which you started. The New command lets you jump to any place on the disk. It will ask for the track and sector number.

The only way to exit Periscope is by choosing the Quit command. This will reset the drive and your computer to their default configurations. Note that the RUN/STOP key is disabled to keep you from breaking out of the program.

Editing Your Disks

The most powerful (and dangerous) of Periscope's commands is Edit. You'll probably want to use this command only with a copy of a disk. With Edit, you can change messages, alter directories, edit text files, correct damaged sector links, and do much more.

Edit displays the current sector on the screen. Use the cursor keys to move the cursor through the data. You will notice that there are two numbers displayed just below the sector data itself. The first num-

ber is the value under the cursor. The second number is a two-byte value obtained from the byte under the cursor and the byte immediately following it. As you move the cursor around the screen, these values will change automatically. The data can be changed simply by typing over it. Two keys end Edit mode: RETURN saves the modified data to disk, and ESC takes you out of edit mode without saving the changes you made.

While in edit mode, you can move throughout the sectors of a file. To do this, move to the first byte of data on the screen and press Alt-C. You'll move to the next sector of the file. Press Alt-B to go backward. If there is a track and sector pointer within a sector (as is the case with the sectors that hold the directory), you may move the cursor to the first byte of the pointer and use Alt-C to move to that sector.

Periscope is a powerful program. Be careful when you use it.

See program listing on page 92. ■

data in a disk sector. If the editor you are using can also follow sector pointers or pointers under the cursor, or if it can display the numeric value of the data, so much the better.

Begin your trace by doing the same things that DOS would do. First go to the first directory sector. For 5¼-inch disks, this is almost always track 18, sector 1. For 3½-inch disks, track 40, sector 1. You should be able to see eight filenames scattered throughout the displayed sector. If you are tracing a GEOS file, you may have difficulty recognizing the filenames. That's because GEOS uses standard ASCII instead of Commodore ASCII. If the file you want to trace isn't in the current sector, follow the pointer in the first two bytes of the sector to the next directory sector. Keep searching directory sectors until you find the file. Next, look at the third byte before the filename of your file. This is the file type identifier byte. The following table shows the character and numeric representation for each of the different file types. If the file you are tracing has been scratched, you can easily "unscratch" it by changing the file type identifier byte to a value other than 0. Be sure to change it to one of the values in the table above or your

Character	Numeric	File Type
@	0(\$00)	Scratched file (pointers may not be valid)
a	129(\$81)	Sequential
b	130(\$82)	Program
c	131(\$83)	User
d	132(\$84)	Relative
e	133(\$85)	CBM (1581 only, partition area)
A	193(\$C1)	Sequential locked
B	194(\$C2)	Program locked
C	195(\$C3)	User locked
D	196(\$C4)	Relative locked
E	197(\$C5)	CBM locked (1581 only)

(The character representations for locked or unlocked sequential, program, user, relative, and CBM files will appear in reverse video.)

disk drive may become confused.

The two bytes just before the filename in a directory entry point to the first sector of data for the file. The first byte is the track, and the second is the sector. Follow the pointer to the file by either moving the cursor over the first byte of the pointer and executing the command to follow the link under the cursor or by examining the bytes yourself to find the track and sector and manually moving to that sector. Either way you should be looking at the first sector of the file.

As with most disk sectors, the

first two bytes of a data sector are a pointer to the next sector of the file. If the file you are looking at is a program file, the second two bytes of the first data sector are the LOAD address of the file. The remaining bytes are the data of the file itself. Of course, some of the more complicated file types, such as random files and relative files, have a somewhat different file structure, but most Commodore files are arranged this way.

With this information under your belt, you should be able to unscratch a file, change a file's type, or even find the load address of a file. For more information about Commodore disk drives, check the user's guide that came with your drive. Two very helpful books on the subject are *The 1541 User's Guide* by Dr. Gerald Neufeld (published by Brady), and *Inside Commodore DOS* by Dr. Richard Immers and Dr. Gerald Neufeld (published by Reston).

A disk sector editor can be a wonderful tool for reconstructing damaged disks, but if you're not careful, you can use it to turn your disk into a scrambled mess. Extreme caution is essential. Always work on a copy if you're trying to recover data from a damaged disk.

64 Keyboard Enhancer

Vivek Jhaveri

Add the power of the 128's editing functions to your 64 with this dynamic program. A customizer program is also included to let you tailor it to your needs.

The Commodore 64 has a good screen editor, but the 128 has shown us what a great screen editor is like. While the 64's editor provides the essentials and little more, the 128's editor has plenty of useful features to make life much easier. The ESC key, for example, adds 27 editing and screen control enhancements when used in conjunction with various keys. Also, the function keys can be easily redefined, so typing frequently used keywords is made simple.

"64 Keyboard Enhancer" and "Keyboard Enhancer Customizer" add 21 new features to the 64, including the 128's 11 ESCape sequences, four redefinable function keys, five keys to change colors, and one key whose function can be defined by the user.

Installation

Since Keyboard Enhancer (Program 1) is written in machine language, you need to enter it with "MLX," the machine language entry program found elsewhere in this issue. When you run MLX, you're asked for the starting address and ending address of the data you'll be entering. Here are the values to use for Keyboard Enhancer:

Starting address: C000
Ending address: C48F

Follow the MLX instructions carefully, and be sure to save a copy of the Keyboard Enhancer data before you finish typing. Now, reset your computer by turning it off and on; then load Program 1 using

the syntax

LOAD "filename",8,1 (for disk),

or

LOAD "filename",1,1 (for tape),

where *filename* is the name you used when you saved the Keyboard Enhancer data. When the program has loaded, type NEW—to reset important memory pointers—followed by SYS 49152, to start the program.

The Commands

Keyboard Enhancer commands can be used from direct mode or from within a program. When used in direct mode, all commands are preceded by a press and release of the control key. From inside a program, the commands can be used by issuing a SYS command followed by the appropriate address. See the table within this article for a cross reference of commands and SYS addresses. Now let's take a look at each command.

CTRL V and **CTRL W** scroll the screen up or down by one line, respectively. CTRL V is useful as an alternative to the normal scroll upwards (by two lines). Both CTRL V and CTRL W can be used in conjunction with smooth scrolling. (See the *Commodore 64 Programmer's Reference Guide*, page 128, for more information on smooth scrolling.) Note that text which scrolls off the screen can't be recovered when the screen is scrolled in the opposite direction.

CTRL P erases everything from the beginning of the current screen row

on which the cursor lies to the position of the cursor. CTRL Q is the mirror image of CTRL P. It erases everything from the cursor position to the end of the current screen row. Unlike ESC P and ESC Q on the Commodore 128, which operate on *program lines* (sometimes call *logical lines*), CTRL P and CTRL Q affect screen lines (sometimes called *physical lines*) only. To understand the distinction, think of a program line that occupies two rows on the screen. The rows spanned by the program line form two physical or screen lines, but only one logical or program line.

CTRL @ takes the idea of CTRL Q one step further and erases everything from the cursor position to the bottom right corner of the screen.

CTRL D erases the current screen line without changing the cursor position. Like CTRL P and CTRL Q, it affects screen lines only.

CTRL J and **CTRL K** make it easy to move the cursor from one end of the current screen line to the other. CTRL J moves the cursor to the beginning of the current line, and CTRL K moves it to the end of the current line.

CTRL M disables screen scrolling, and **CTRL L** reenables screen scrolling. CTRL M is useful when you want to put something at the bottom right corner of the screen without scrolling the screen up. Note, however, that CTRL M does not affect the functions of CTRL V and CTRL W. It only affects normal scrolling, not those scrolling functions added by this program.

CTRL O disables Quote and Insert modes. This comes in handy if you want to move the cursor inside a

Keyboard Enhancer Cross Reference Table

Sequence	SYS address	Function
CTRL V	49678	Scroll screen up one line
CTRL W	49500	Scroll screen down one line
CTRL P	49947	Erase to start of line
CTRL Q	49985	Erase to end of line
CTRL @	50089	Erase to end of screen
CTRL D	50043	Erase current screen line
CTRL J	49919	Move cursor to start of line
CTRL K	49933	Move cursor to end of line
CTRL L	50031	Enable scrolling
CTRL M	50037	Disable scrolling
CTRL O	49912	Cancel Quote and Insert modes
CTRL +	50081	Increment border color
CTRL -	50085	Decrement border color
CTRL *	50089	Increment screen color
CTRL †	50093	Decrement screen color
CTRL X	50180	Change colors to default colors
CTRL f1	50196	Print stored string #1
CTRL f3	50226	Print stored string #2
CTRL f5	50256	Print stored string #3
CTRL f7	50286	Print stored string #4
CTRL U	50316	User-defined sequence (see text)

quotation without printing reversed graphics characters, as would otherwise happen.

CTRL + and **CTRL -** increase or decrease the value for border color, respectively. Suppose that the border color is white, which has a value of 1. Pressing **CTRL -** changes the border color to black, which has a value of 0.

CTRL * and **CTRL †** adjust screen color. **CTRL *** and **CTRL †** increase or decrease its value by 1, respectively.

CTRL X sets the border, screen, and cursor colors to their default values. As written, the program defaults to a blue screen and border, with a cyan cursor. These default values can be changed, if you like, using the Keyboard Enhancer Customizer program (discussed below).

CTRL f1, **CTRL f3**, **CTRL f5**, and **CTRL f7** all cause a stored string of as many as ten characters to print on the screen. As written, the program has no stored strings, but you can store your own strings for these sequences using the Customizer program.

CTRL U is a user-defined sequence. You can use your own machine language subroutine to determine what will happen when this sequence is pressed. Your subroutine must start at address 50316 and end with an RTS instruction. Then, if **CTRL U** is pressed, your own subroutine is automatically executed.

To combine your machine language for **CTRL U** with Keyboard Enhancer, follow these steps:

- Load Keyboard Enhancer using `LOAD "filename",8,1` (use ,1,1 for tape); then type **NEW**.
- Load your own assembled subroutine in the same way. The starting address should be 50316. Don't forget to type **NEW**.
- Enter the line

```
POKE 43,0:POKE 44,192:POKE 45,A-
A=(INT(A/256)*256):POKE 46,
INT(A/256)
```

where *A* is the ending address of your subroutine.

- Type `SAVE "filename",8` (,1 for tape).
- Switch your 64 off and on to reset it.
- Load the program that you just saved with `LOAD "filename",8,1` (again, use ,1,1 for tape). Type **NEW** and enter **SYS 49152** to start the program.

Now try typing **CTRL U**. Your own special subroutine should be executed.

Note that if you type **CTRL x**, where *x* is any letter that is part of a sequence, and then press *x* again, the letter won't be displayed. This can be overcome by pressing any other key between **CTRL x** and *x*. For example, if you press **CTRL P** followed by **P**, the **P** won't be displayed. However, any intervening keypress allows the **P** to be displayed. This is not a program bug,

rather a required limitation included for technical reasons. In most cases, it will not present a problem.

Keyboard Enhancer can be disabled by pressing the **RUN/STOP-RESTORE** combination. It can be reenabled with **SYS 49152**.

Using The Customizer

Keyboard Enhancer Customizer (Program 2) is written entirely in BASIC. To install it, type it in, save a copy to disk, and type **RUN**. It allows you to create your own strings for the function-key sequences and for **CTRL X**, the default colors.

Before you run the Customizer, you need to load the Keyboard Enhancer program itself as you normally would. Don't enable it yet, though, and don't forget to type **NEW** after you've loaded it.

Next, load and run Program 2. It displays the current function-key strings one by one and asks you for a new string for each. If you don't want to change the string, press **RETURN** at the prompt.

If you do want to change the string, enter the new string (up to ten characters), using the **DEL** key to correct mistyped characters. If you want to use **RETURN** as part of the string, enter a back arrow. The program will interpret this as a **RETURN**. Similarly, the apostrophe (') will be interpreted as a double quotation mark ("). This is useful if you want to define a function key to execute a command.

Once you've entered all four definitions, the program asks for your default border, screen, and cursor colors. Enter a number between 0 and 15 for each choice. For a complete list of colors and their corresponding numbers, refer to the manual that came with your computer.

Now, the program will end with all your changes in their correct place in memory. To save your customized version of Keyboard Enhancer, type

```
POKE 43,0:POKE 44,192:POKE 45,A-
INT(A/256)*256:POKE 46,INT(A/256)
```

where *A* is 50317 or, if you've written a machine language subroutine for **CTRL U**, the ending address of your subroutine. Next, enter `SAVE "filename",8` (use ,1 for tape).

See program listings on page 90. ■

Relative Ease

Jeffrey D. Partch

In spite of their power, speed, and flexibility, relative files have always been difficult to program on the 64, and for this reason, most 64 programmers have avoided them. "Relative Ease" changes all that by making this powerful file type as easy to use as sequential or program files. For the 64 with 1541, 1571, or 1581 disk drive.

Relative files offer far more speed and efficiency than any other file type available for data storage. With almost random access, individual entries in a relative file can be read from, written to, added to, or replaced at will. And since most of the processing chores are handled by the disk operating system (DOS), relative files are less prone to error than other types. In fact, only a handful of computer-based commands are even necessary to manage this versatile file type. BASIC 2.0, however, doesn't provide us with much help.

Relative file management using only BASIC 2.0 DOS commands is tedious and can be intimidating for the inexperienced. Many programmers have taken one look at relative files and given them up completely. This is unfortunate, because the relative file is perhaps the most powerful and fascinating feature of Commodore DOS. Commodore seems to have recognized the problem, because all of its post-64 machines provide DOS commands that greatly simplify using relative files. "Relative Ease" offers these enhancements to 64 programmers.

Getting Started

Since Relative Ease is written in machine language, you'll need to enter it with the "MLX" machine language entry program found elsewhere in this issue. When you run MLX, you're asked for the starting address and ending address of the data you'll be entering. Here are the values to use for Relative Ease:

Starting address: C000
Ending address: C2AF

Follow the MLX instructions carefully, and be sure to save a copy of the Relative Ease data before you finish typing. Load Relative Ease with the command

LOAD"RELATIVE EASE",8,1

When the READY prompt returns, simply type SYS 49152 to activate the utility and restore some important BASIC pointers. If you want to use Relative Ease from inside a BASIC program, please remember that the startup routine clears all variables.

Relative Files

A relative file is nothing more than an expandable allocation of unused blocks or sectors on the disk. Each

block has 254 bytes available for the storage of user-supplied data. DOS assigns these blocks to the relative file as required, allowing the file to grow with the demand.

Side sectors are special ancillary blocks unique to relative files. Each side sector has room for 120 two-byte block pointers that allow DOS to locate quickly the various blocks assigned to the file. As many as six side sectors may be assigned to a single relative file, so in theory, a relative file could expand to include as many as 720 ($6 \times 120 = 720$) primary storage blocks plus six additional side sector blocks (726 blocks total). However, 1541 users are limited to a maximum file size of 658 primary storage blocks, because single-sided disks never contain more than 664 blocks ($664 - 6 = 658$).

Records And Lengths

Individual entries in a relative file are called *records*, and a single relative file may expand to include as many as 65,535 records. In most cases, the actual number will probably be much smaller. The number of records per file is determined by the limitations of disk space and the size of the record.

Record size—or more specifically, record length—is the maximum number of characters that can possibly be contained in each record. You make the initial decision, but the value is assigned to the file by DOS when it's first created.

DOS allows record lengths to be no less than 1 character and no more than 254. Since one character in every record must be used as an imposed delimiter, this effectively raises the lower limit to at least 2 characters per record. Every record in the file is assigned the same length by DOS.

It should be noted that there are three length values that DOS will not accept: 42, 58, and 63. These lengths are rejected because these numbers have ASCII representations ("*", ":", and "?") with special meaning to DOS. If you accidentally use one of the values, you simply get a syntax error.

Here is a short BASIC program that calculates the maximum number of possible records for any given file. To use it, you need to supply the number of free blocks on the disk and the size of the record you intend to use.

```
20 BF=664:PRINT"NUMBER OF BLOC
  KS FREE ";BF;
30 POKE211,21:INPUT BF:IF BF>6
  64 THEN BF=664
40 INPUT"RECORD LENGTH";RL:IF
  (SPACE)RL<1 OR RL>254THEN
  40
50 SS=INT((BF/120)+.99):BA=BF-
  SS
60 RP=INT(BA*254/RL):IF RP>655
  36 THEN RP=65535
70 PRINT"[RVS] THERE ARE";RP;"
  {LEFT} RECORDS POSSIBLE.
  {SPACE}"
```

Fields And Format

In many cases, records can be subdivided into even smaller lengths called *fields*. Fields can have either a fixed or a variable length. Say, for example, that the records in a magazine index program contain the following fields: (1) Issue no., (2) Date, (3) Title, (4) Article, (5) Page, and (6) Subject.

With variable-length fields, each field is separated with a delimiter such as a comma or a carriage return, but is allowed to seek its own length. The only restriction is that the total length of all fields, including the delimiters, doesn't exceed the length of the record.

Using fixed-length fields, the programmer can reserve a specific number of bytes for each field. For example, 5 bytes can be reserved for the issue number, 6 bytes for the date, 20 bytes for the title, and so on. When you're using this method, shorter entries have to be padded to full length, and longer entries trun-

cated to make them fit. Again, each field should be separated with a delimiter. The advantage of this method is that the location of each field is always known. The date field always starts at position 6, the title field at position 12, and the article field at position 32.

Each method has its advantages and disadvantages. The decision is up to you, but in most instances, it's a good idea to design your records so INPUT# can be used to read the information.

GET# And INPUT#

Records and fields are retrieved using either a GET# or an INPUT# statement. GET# simply retrieves characters one at a time and recognizes no delimiters. Programs that use GET# need to assemble each string manually and specifically check for delimiters.

INPUT# is faster and easier to use than GET#, because it retrieves entire strings and recognizes the usual delimiters (commas, colons, and carriage returns) automatically. The important thing to remember about INPUT# is that string lengths can never exceed 88 characters.

Three New Commands

All the commands supplied by Relative Ease can accept variable as well as literal arguments in place of their specific parameters. Variable arguments must be of the type and value expected by the command. Optional parameters may be omitted from the command syntax, but all parameters which are included should appear in the proper order. The first command in Relative Ease is DOPEN.

DOPEN is used to create relative files and to open them for processing. Unlike other file types, relative files are opened for simultaneous reading and writing. The computer allows as many as ten files to be open at any given time, but DOS allows access to only one relative file per disk drive.

Because sequential files, and possibly even program files, are often used in conjunction with relative files, the DOPEN command provides a variety of optional parameters to support these file types. The complete syntax looks like this:

```
DOPEN#lfn,"filename,type",Lrecord-
length,Udevicenum,W
```

The *lfn* parameter should be replaced with a specific logical file number in the range 2-255. *Filename* must be a valid string of up to 16 characters (control characters and most punctuation marks should be avoided). The *type* parameter signals DOS that a specific file type (S for sequential, P for program, R for relative) is intended. Normally DOS is unconcerned with file type when files are opened for reading, but specifying the file type forces the issue and triggers a disk error if the comparison fails.

The *recordlength* parameter tells DOS how many characters will be contained in each record of the file. The allowable range is at least 1 with no more than 254 characters per record (again, with the exceptions of 42, 53, and 68). The initial decision is yours, but once the record length has been set by DOS, it can't be changed without some complex track and sector editing. This parameter must be included to create a new relative file.

The *devicenum* parameter allows you to specify an alternate disk drive. Values supplied must be in the range 8-30. The DOPEN command defaults to device number 8 if an output device is not specified.

The *W* parameter tells DOS that a new file is to be opened for writing (created). The default file type is sequential, but program files may be opened if specified by the type parameter. This parameter is not intended to be used with relative files (which are created using the *L* parameter discussed above).

Records are accessed through DOS by their record number using the RECORD command.

```
RECORD#lfn,recordnumber,character-
position
```

The same logical file number that was used to open the relative file must replace the *lfn* parameter in this command. The second parameter, *recordnumber*, accepts any value in the range 1-65,535. The value depends on which record you intend to process.

The third parameter, *characterposition*, allows you to position the record pointer to a specific character location within the record. To use this parameter effectively, fixed-length fields should be specified. Since this is an optional facet of relative file management, this is an op-

tional parameter. The default value is 1—the first character in the record.

The final command, DCLOSE, provides greater flexibility than the normal CLOSE command. The following variations are possible:

```
DCLOSE
DCLOSE ON Udevicenumber
DCLOSE#lfn
DCLOSE#lfn ON Udevicenumber
```

The first variation closes all files currently open on disk drive number 8. The second variation performs the same function, but on the drive specified by *devicenumber*. The third variation closes the specified logical file number (*lfn*), which is open on device number 8, and the fourth variation closes the file number and allows the disk drive to be specified, too.

Reading The Error Channel

Relative Ease takes advantage of the little-used USR function to provide a simulation of the DS\$ variable found in higher-level versions of Commodore BASIC. The following variations are useful:

```
PRINT USR(devicenumber)
DS$=USR(devicenumber)
IF VAL(USR(devicenumber))=50 THEN ...
```

The function simply reads the error channel on the disk drive specified by *devicenumber* and returns the string for processing. Because the disk error condition is cleared each time it's read, it's a good idea to store the string in a variable and process its contents later. Note that the numeric equivalent of the error message can be obtained with the VAL function.

Three error conditions apply specifically to relative files:

```
50, RECORD NOT PRESENT
51, OVERFLOW IN RECORD
52, FILE TOO LARGE
```

Error number 50 indicates that DOS was unable to locate the record requested. If this error occurs while a new file is being created, it may simply be ignored. During a write operation this error is valid only when expansion is undesired; otherwise this error is simply a confirmation that expansion has occurred. During a read operation this error indicates that the record pointer has been pushed past the end of the file. This error is not, however, a reliable method of detecting the last valid record.

Error number 51 indicates that

more data has been sent to the record than it was configured to hold and that the information has been truncated. To avoid this error, always check the length of output strings before they are sent to the disk drive. Also, be sure to include a carriage return in your record length estimates. PRINT# sends a carriage return at the end of each string.

Error number 52 indicates that there is no more room left on the disk. This error only occurs during the creation of a new file or during the expansion of an existing one. One other error condition, 70, NO CHANNEL .00,00, occurs when more than one relative file is opened on a particular disk drive or when you open a file with a record length of 42, 58, or 63.

Creating A New File

Before a relative file can be created, you should know your record length and have a general idea of the number of records you'll need. Deciding on an approximate number of records is important for several reasons. First, since it takes additional time for DOS to create new records, it saves time if an appropriate number exists in advance. Second, it ensures that there is an adequate amount of space available on the disk. Third and most important, a certain number of blocks must be assigned to a file before it will function properly.

The following program creates a new relative file using Relative Ease commands. Before running this program, be sure Relative Ease has been loaded.

```
10 PRINT"{CLR}{RVS} CREATE A N
   EW RELATIVE FILE "
20 DOPEN#2,"ERROR FILE",L22,U8
30 RECORD#2,29,1
40 PRINT#2,CHR$(255)
50 DS$=USR(8):DS=VAL(DS$):IF D
   S>0 AND DS<>50 THEN PRINT
   DS$
60 DCLOSE
```

The file is created in lines 20-40. Line 20 opens the file, line 30 advances the record pointer to the last record, and line 40 writes the value CHR\$(255) to this final record. CHR\$(255) is the value used by DOS to initialize or mark the beginning of new records. In this instance, every record in the file is initialized, and the necessary number of blocks is allocated to the file. DOS never allocates less than a full

block to a relative file, and it always creates as many records as the block will contain.

For example, in the above program line 30 instructs DOS to create 29 records of 22 characters each, but in fact, 34 records are actually created. Here's why: 22 characters × 29 records = 638 bytes. Each block can contain 254 bytes, so three blocks are allocated to the file. Three blocks (or 762 bytes) / 22 characters = 34 complete records. The number of extra records increases as record size decreases and vice versa. No additional records are created for lengths greater than 127 characters, because only one complete record can fit into any given block. This rule applies to the expansion of files as well.

Line 50 simply reads the error channel and prints the message if an error has occurred. Notice that error number 50 is specifically ignored, because in this case it's expected: We're writing to a record that isn't present, because no records are present in a new relative file.

Writing To A Relative File

Once a relative file has been properly created on the disk, it may be opened with or without the record-length parameter, L. As long as the length specified matches the length assigned to the file, no error occurs. The RECORD command is used to locate a particular record, and the BASIC 2.0 PRINT# command is used to write information to the file. The following program reopens the file we created earlier, and stores a different BASIC error message into the first 29 records.

```
10 PRINT"{CLR}{RVS} WRITE A RE
   LATIVE FILE "
20 DOPEN#2,"ERROR FILE",L22,U8
30 S=41373:ERR$="":ER=ER+1
40 Y=Y+1:V=PEEK(S+Y)
50 ERR$=ERR$+CHR$(V AND 127)
60 IF V<128 THEN GOTO40
70 RECORD#2,ER:GOSUB 500
80 PRINT#2,ERR$:GOSUB 500
90 IF ER<29 THEN GOTO 30
95 DCLOSE:END
500 DS$=USR(8):DS=VAL(DS$)
501 IF DS=0 OR DS=50 THEN RETU
   RN
502 PRINT DS$:DCLOSE:END
```

Line 20 reopens the file. Line 30 clears the output string and updates the record counter. Lines 40 and 50 assemble each error message into the output string, and line 60 checks for the end of each message. Line 70 positions the record pointer

and checks for disk errors. Line 80 sends the output string to the disk drive and also checks for disk errors. Line 90 reenters the loop until all 29 records have been filed. Finally, line 95 closes the file when we've finished.

Reading A Relative File

The following program randomly reads various entries from our example file. The INPUT# command is used because no potential conflicts exist in the simple record format. (This program is used again in the next section, so type it in carefully.)

```
10 PRINT "{CLR}{RVS} READ RECORDS BACK "
```

```
20 DOPEN#2,"ERROR FILE",US
```

```
30 EN=0:ERR$=""
```

```
40 INPUT"ENTER A RECORD NUMBER ";EN
```

```
50 IF EN=0 THEN DCLOSE:END
```

```
60 RECORD#2,EN,1
```

```
70 GOSUB 500:IF DS=50 THEN 90
```

```
80 INPUT#2,ERR$:IF ERR$=CHR$(255) THEN 90
```

```
81 PRINT "{UP}ERROR NO." + STR$(EN) + " IS - ";CHR$(34);ERR$;CHR$(34)
```

```
89 GOTO 30
```

```
90 PRINT "{UP}{RVS}ERROR MESSAGE";EN;"{LEFT} IS NOT ON FILE "
```

```
91 GOTO 30
```

```
95 DCLOSE:END
```

```
500 DS$=USR(8):DS=VAL(DS$)
```

```
501 IF DS=0 OR DS=50 THEN RETURN
```

```
502 PRINT DS$:DCLOSE:END
```

Line 20 reopens the file. Line 30 clears the record counter and the input string. Line 40 inputs a record value from the user and stores it in the variable EN. Line 50 allows you to quit the program by inputting a 0 or by just pressing the RETURN key at the prompt. Line 60 positions the record pointer, and line 70 checks for disk errors. Notice that error number 50 causes special action. In line 80 the record is retrieved and a special test is made for unused records. Line 81 executes when no disk errors have occurred and a valid record was retrieved. In this case, the record text is formatted and displayed on the screen. Line 90 is executed when error number 50 is encountered or an unused record is retrieved. In this case, the message RECORD NOT ON FILE is displayed. In either case, the main loop is reentered.

Updates And Modifications

At this point, it seems as though the true power of relative files has been

overlooked. First we opened the file, wrote to the file, and closed the file. Next we reopened the file, read the file, and closed it again. The important thing is that we didn't really have to close the file at all. Once a relative file has been opened, it can be written to and read from whenever the need dictates.

For a demonstration, add the following lines to the previous program.

```
10 PRINT "{CLR}{RVS} MODIFY RECORDS "
```

```
81 PRINT "{UP}MODIFY RECORD"+STR$(EN)+CHR$(32);
```

```
82 CP=PEEK(211):PRINT "{2 SPACES}";ERR$;POKE 211,CP
```

```
83 MOD$="":INPUT MOD$:IF MOD$="" THEN MOD$=CHR$(255)
```

```
84 IF LEN(MOD$)<22 THEN 86
```

```
85 PRINT "{UP}{RVS}STRING TOO LONG ERROR - 21 CHARS MAX {DOWN}":GOTO 81
```

```
86 RECORD#2,EN,1:GOSUB 500
```

```
87 PRINT#2,MOD$:GOSUB 500
```

```
88 RECORD#2,EN,1:GOSUB 500
```

```
90 PRINT "{UP}{RVS}ERROR MESSAGE";EN;"{LEFT} IS NOT ON FILE "
```

```
91 PRINT"ENTER NEW RECORD";GOTO 83
```

Lines 81 and 82 format an input statement with the current record

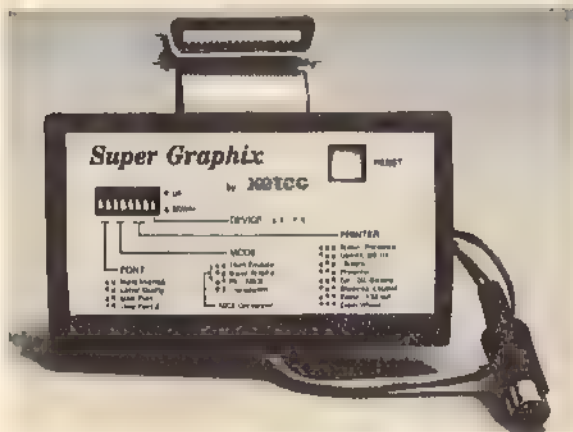
string on the right. Line 83 stores the modified string into the variable MOD\$ and checks to see whether the string was erased. In this case, CHR\$(255) is stored in the record to indicate that it's now unused. Line 84 determines whether the new length will fit the record. If not, an error message is displayed and the modification loop reentered. Line 86 is where the real action begins.

Line 86 sets the record pointer. In line 87 the modified record is stored back in the file, and in line 88, the record pointer is set again. This is a very important step that's harder to explain than it is to do. Remember always to position the record pointer both before and after updating (reading and then rewriting) a record. Line 91 allows new records to be filed or created when unused records or an error number 50 is encountered.

So far, we've discussed creating a file, writing records, reading records, and changing records. The record format may have been simple in the examples, but the mechanics will be the same no matter how complex your records.

See program listing on page 92. ■

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The demonstration programs included with "Hi-Res Screen Show" dynamically show the power of the 128's BASIC 7.0 drawing commands. Pictured above are Demos 1-3.

Hi-Res Screen Show For The 128

Rob Kennedy

The fact that the Commodore 128 is one of the most powerful and easy-to-use graphics machines available today is displayed in these five dazzling demonstration programs. Each one gives a different display every time it is run. A color monitor shows them at their best.

The Commodore 64 is an incredible graphics machine. When it first appeared, its graphics and sound capabilities were years ahead of their time. Unfortunately, the 64's sound and graphics couldn't be programmed effectively without a knowledge of machine language.

When the 128 arrived, it not only had super graphics, but it included a new, more powerful version of BASIC that made programming graphics easy. The five demonstration programs included in "Hi-Res Screen Show" illustrate the power and flexibility of the 128's graphics commands. Graphics that take hundreds of POKES on a 64 require just a few commands with the 128's BASIC 7.0. (For more information on programming hi-res graphics, see "Hi-Res Graphics on the 128" in the June and July 1987 issues of COMPUTE!'s Gazette.)

Getting Started

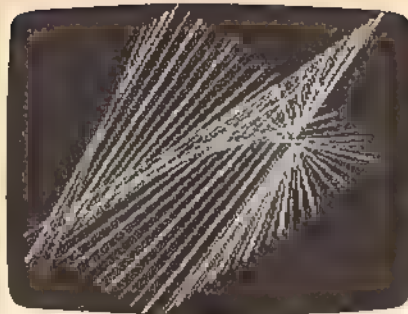
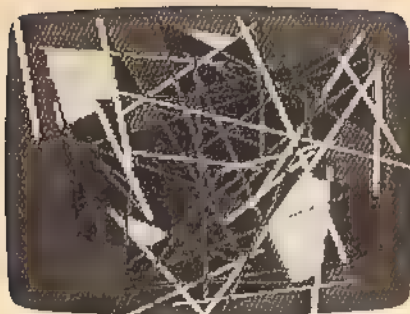
Since all five demos are written in BASIC, simply type each one in and save it to disk. To display a demo, load it and type RUN, or simply type RUN followed by the filename. Here's a brief discussion of each program.

Demo 1 creates an entertaining hi-res display using just 18 lines of BASIC. It draws a box, increments its coordinates, then redraws the box. If any part of the box touches an edge of the screen, the box bounces off and moves in the opposite direction. Every 15 seconds the screen clears to remove the jumble of lines, and the drawing begins again. To quit this demo, or any of the others, press any key. If you want to experiment with the program, change the values stored in line 60 and the lower limits in lines 110-140.

Demo 2 works its magic using only the CIRCLE command. It draws circles, one after another, changing the angle for each one. Each time it completes the inner loop, the program changes the circle increment to a higher value, and the circles are drawn more quickly.

The two circle parameters—*angle* and *inc*—are responsible for the designs in this program. The value of *angle* determines the rotation of the circle in degrees clockwise. *Inc* tells the number of degrees of arc per line segment. When you change this value, you change the drawing's shape. For example, a value of 180 for *inc* produces a line (360 divided by 180 is 2). If the value is 90, you get a four-sided figure, while 120 produces a triangle, and 45, an octagon.

Demo 3 draws a V on the screen using the BOX command. The first segment of the program draws the left side of the V, and the second segment, the right side. First, the program draws a box and fills it. Then it changes the color source, and increments the X and Y parameters and the angle (so the



Demos 4 and 5 use line drawing and fills to create artistic displays

boxes appear to rotate). To experiment with this program, change the values in lines 80 and 140.

Demo 4 is one of the most enjoyable to watch. It continually

draws lines, with each end moving independently of the other. If one end meets the edge of the screen, it bounces off. As in the box demo, the screen clears every 15 seconds.

Try experimenting with this program by changing the values in lines 50 and 60.

Demo 5 is somewhat difficult to describe since no two displays are ever the same. A continuous line is drawn in 50 segments, and 25 random locations on the screen are selected and filled in. A number of impressive designs are possible using this technique. If you'd like to save one of your designs, type in the following line:

BSAVE "filename",B0,P7168 TO P16383

You can reload the picture with **BLOAD "filename", B0**

See program listings on page 80. ■



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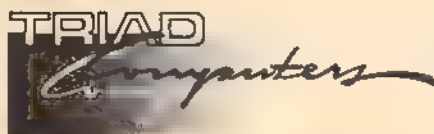
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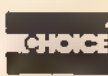
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Power BASIC: Fast Hi-Res Screen Dump

Article on page 58.

```

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ALL RIGHTS RESERVED
QP 20 REM FOR COMMODORE GRAPHI
C MODE PRINTERS (1525, M
PS-801, MPS-803, ETC.)
RQ 30 SL=8192:REM HI-RES SCREE
N LOCATION
DK 40 PRINT "{CLR}{3 SPACES}COP
YRIGHT 1988 COMPUTE! PUB
., INC."
JB 50 PRINTTAB(11)"ALL RIGHTS
{SPACE}RESERVED"
EH 60 IFPEEK(65530)=5THENBANK1
5
FG 70 INPUT"[2 DOWN]ENTER STAR
TING ADDRESS";S
EQ 80 FORI=STOS+237:READD:POKE
I,D:X=X+D:NEXT
PM 90 IFX<>34823THENPRINT"
[2 DOWN]ERROR IN DATA ST
ATEMENTS"
FE 100 SL=SL+7671:HB=INT(SL/25
6):LB=SL-256*HB
KC 110 POKES+57,LB:POKES+61,HB
:POKES+65,LB+8:POKES+69
,HB
XR 120 PRINT"[2 DOWN]HIRES DUM
P INSTALLED.":PRINT"SYS
"S"TO ACTIVATE."
RX 130 DATA 169,0,32,189,255,1
69,1,162
BS 140 DATA 4,160,0,32,186,255
,32,192
BS 150 DATA 255,169,0,32,189,2
55,169,21
QQ 160 DATA 162,4,160,21,32,18
6,255,32
DA 170 DATA 192,255,162,1,32,2
01,255,169
MF 180 DATA 8,32,210,255,169,0
,133,80
FE 190 DATA 133,82,133,83,169,
25,133,81
ME 200 DATA 169,247,133,250,16
9,61,133,251
JP 210 DATA 169,255,133,252,16
9,61,133,253
SQ 220 DATA 160,8,177,250,133,
254,177,252
CJ 230 DATA 133,255,166,80,240
,7,70,254
EK 240 DATA 102,255,202,208,24
9,162,8,102
BK 250 DATA 255,38,254,202,208
,249,165,83
PP 260 DATA 240,4,37,254,133,2
54,169,128
JP 270 DATA 5,254,32,210,255,1
36,208,210
RS 280 DATA 240,3,24,144,203,5
6,165,250
RP 290 DATA 233,64,133,250,165
,251,233,1
AF 300 DATA 133,251,56,165,252
,233,64,133
HX 310 DATA 252,165,253,233,1,
133,253,198
SB 320 DATA 81,208,173,169,25,
133,81,169
HQ 330 DATA 13,32,210,255,230,
80,165,80
BR 340 DATA 201,8,208,14,169,0
,133,80
KC 350 DATA 162,8,198,250,198,

```

```

252,202,208
FS 360 DATA 249,24,165,250,105
,72,133,250
PS 370 DATA 165,251,105,31,133
,251,24,165
FG 380 DATA 252,105,72,133,252
,165,253,105
JS 390 DATA 31,133,253,230,82,
165,82,201
QH 400 DATA 45,144,159,201,46,
240,6,169
HB 410 DATA 31,133,83,208,149,
32,204,255
SS 420 DATA 169,1,32,195,255,9
6

```

128 Hi-Res Demos

Article on page 78.

Demo 1

```

AJ 10 REM COPYRIGHT 1988 COMPU
TEI PUBLICATIONS, INC.
{2 SPACES}ALL RIGHTS RES
ERVED
RH 20 PRINT "{CLR}{3 SPACES}COP
YRIGHT 1988 COMPUTE! PUB
., INC."
MJ 30 PRINTTAB(11)"ALL RIGHTS
{SPACE}RESERVED":SLEEP2
XE 40 GRAPHIC3,1:COLOR0,1:COLO
R4,1:COLOR1,2:COLOR2,3:C
OLOR3,7
GJ 50 X1=5:Y1=5:X2=10:Y2=6
GF 60 X=4:Y=4:XT=5:YT=5:AN=5
MM 70 TI$="000000"
CX 80 DO
AA 90 C=C+1:IFC=4THENC=1
CH 100 BOXC,X1,Y1,X2,Y2,A
PR 110 IFX1>154ORX1<5THENX=X*-
1:AN=AN*-1
MC 120 IFX2>153ORX2<6THENXT=XT
*-1:AN=AN*-1
KF 130 IFY1>194ORY1<5THENY=Y*-
1:AN=AN*-1
QM 140 IFY2>193ORY2<6THENYT=YT
*-1:AN=AN*-1
EG 150 A=A+AN
SE 160 IFTI$="000015"THENTIS$="
000000":SCNCLR
QE 170 X1=X1+X:X2=X2+XT:Y1=Y1+
Y:Y2=Y2+YT
KJ 180 IFA<1THENA=360
QJ 190 IFA>360THENA=1
RP 200 GETA$:IFAS<>"":THENGRA
PH IC0:END
DP 210 LOOP

```

Demo 2

```

AJ 10 REM COPYRIGHT 1988 COMPU
TEI PUBLICATIONS, INC.
{2 SPACES}ALL RIGHTS RES
ERVED
RH 20 PRINT "{CLR}{3 SPACES}COP
YRIGHT 1988 COMPUTE! PUB
., INC."
MJ 30 PRINTTAB(11)"ALL RIGHTS
{SPACE}RESERVED":SLEEP2
XE 40 GRAPHIC3,1:COLOR0,1:COLO
R4,1:COLOR1,2:COLOR2,3:C
OLOR3,7
HF 50 FORINC=2TO190STEP4:GRA
PH IC3,1
AJ 60 FORANGLE=1TO180STEP15
MC 70 C=C+1:IFC=4THENC=1
JC 80 CIRCLEC,80,100,20,,,ANG
LE,INC
SB 90 GETA$:IFAS<>"":THENGRA
PH IC0:END
RD 100 NEXTANGLE,INC:GETKEYA$:
GRAPHIC0

```

Demo 3

```

AJ 10 REM COPYRIGHT 1988 COMPU
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ERVED
RH 20 PRINT "{CLR}{3 SPACES}COP
YRIGHT 1988 COMPUTE! PUB
., INC."
MJ 30 PRINTTAB(11)"ALL RIGHTS
{SPACE}RESERVED":SLEEP2
RS 40 GRAPHIC3,1:COLOR1,2:COLO
R2,3:COLOR3,7:COLOR0,1:C
OLOR4,1
EA 50 X1=1:X2=12.5
SD 60 Y1=1:Y2=12.5
KG 70 BOXC,X1,Y1,X2,Y2,R,1
AH 80 X1=X1+2.5:X2=X2+2.5:Y1=Y
1+5:Y2=Y2+5:R=R+5
AA 90 C=C+1:IFC=4THENC=1
RC 100 T=T+1:IFT<30THEN70
HD 110 T=0
BP 120 BOXC,X1,Y1,X2,Y2,R,1
RF 130 C=C+1:IFC=4THENC=1
HE 140 X1=X1+2.5:X2=X2+2.5:Y1=
Y1-5:Y2=Y2-5:R=R+5
PB 150 T=T+1:IFT<30THEN120
AR 160 GETKEYA$:GRAPHIC0

```

Demo 4

```

AJ 10 REM COPYRIGHT 1988 COMPU
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ERVED
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., INC."
MJ 30 PRINTTAB(11)"ALL RIGHTS
{SPACE}RESERVED":SLEEP2
AD 40 GRAPHIC3,1:COLOR0,1:COLO
R4,1:COLOR1,2:COLOR2,3:C
OLOR3,15
PJ 50 X1=1:X2=20:Y1=1:Y2=5
MX 60 X=4:XT=5:Y=4:YT=5
QS 70 TI$="000000":C=1
CX 80 DO
GX 90 DRAWC,X1,Y1TOX2,Y2
KH 100 C=C+1:IFC=4THENC=1
ED 110 X1=X1+X:X2=X2+XT:Y1=Y1+
Y:Y2=Y2+YT
XB 120 IFX1>159ORX1<2THENX=X*-
1
JC 130 IFX2>159ORX2<2THENXT=XT
*-1
AG 140 IFY1>199ORY1<2THENY=Y*-
1
XM 150 IFY2>199ORY2<2THENYT=YT
*-1
KF 160 IFTI$="001500"THENTIS$="000
000":SCNCLR
MJ 170 GETA$:IFAS<>"":THENGRA
PH IC0:END
CM 180 LOOP

```

Demo 5

```

AJ 10 REM COPYRIGHT 1988 COMPU
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ERVED
RH 20 PRINT "{CLR}{3 SPACES}COP
YRIGHT 1988 COMPUTE! PUB
., INC."
MJ 30 PRINTTAB(11)"ALL RIGHTS
{SPACE}RESERVED":SLEEP2
HX 40 GRAPHIC3,1:WIDTH2:COLOR1
,2:COLOR2,3:COLOR3,7:COL
OR0,1:COLOR4,1
CJ 50 DEFFNA(X)=INT(RND(1)*160
)+1:DEFFNB(X)=INT(RND(1)
*200)+1
CC 60 FORT=1TO50
FR 70 X1=FNA(X):X2=FNA(X):Y1=F
NB(X):Y2=FNB(X)

```



```

XB 80 C=C+1:IFC=4THENC=1
SR 90 DRAWC,+0,+0TOX2,Y2
HF 100 GETAS:IFAS<>"THENGGRAPH
IC0:END
PB 110 NEXTT
MX 120 FORT=1TO25:X1=FNA(X):Y1
=FNB(X)
RF 130 C=C+1:IFC=4THENC=1
HX 140 PAINTC,X1,Y1,1
CK 150 GETAS:IFAS<>"THENGGRAPH
IC0:END
AR 160 NEXTT:SLEEP2
CX 170 GOTO50

```

The GEOS Column

See instructions in article on page 57 before typing in.

Program 1: Skeet

```

0400:BF FF FF FE 00 10 02 80 A0
0408:7C 03 81 93 03 82 10 03 3E
0410:04 00 43 84 10 43 88 10 B9
0418:23 88 00 23 9E D6 F3 88 C6
0420:00 23 88 10 23 84 10 43 91
0428:04 00 43 82 10 83 81 93 28
0430:03 80 7C 03 80 10 03 80 64
0438:00 03 FF FF FF 3F FF FF FD
0440:83 05 00 FC 04 AA 12 FC 07
0448:04 53 6B 65 65 74 20 20 48
0450:20 20 20 20 20 20 20 20 61
0458:36 00 00 00 00 00 00 00 7B
0460:00 00 00 00 00 00 00 00 68
0468:00 00 00 00 00 00 00 00 70
0470:00 00 00 00 00 00 00 00 78
0478:00 00 00 00 00 00 00 00 80
0480:00 00 00 00 00 FF FF FF 88
0488:FF FF FF FF FF FF FF FF 90
0490:FF FF FF FF FF FF FF FF 98
0498:FF FF FF FF FF FF FF FF A0
04A0:00 00 00 00 00 00 00 00 A8
04A8:00 00 00 00 00 00 00 00 B0
04B0:00 00 00 00 00 00 00 00 B8
04B8:00 00 00 00 00 00 00 00 C0
04C0:00 00 00 00 00 00 00 00 C8
04C8:00 00 00 00 00 00 00 00 D0
04D0:00 00 00 00 00 00 00 00 D8
04D8:00 00 00 00 00 00 00 00 E0
04E0:00 00 00 00 00 00 00 00 E8
04E8:00 00 00 00 00 00 00 00 F0
04F0:00 00 00 00 00 00 00 00 F8
04F8:00 00 00 00 20 E1 C1 20 2D
0500:8A C1 A9 80 85 2F 20 A8 CE
0508:C1 05 01 01 20 00 88 03 79
0510:E8 00 30 07 20 00 88 05 1C
0518:00 01 20 00 90 03 F0 00 D9
0520:20 07 28 00 90 00 20 AE 78
0528:C1 62 00 49 20 43 6E 70 9D
0530:79 72 69 67 68 74 20 31 BD
0538:39 38 38 00 20 AE C1 4E 81
0540:00 5A 43 4F 4D 50 55 54 E8
0548:45 21 20 50 75 62 6C 69 BD
0550:63 61 74 69 6F 6E 73 20 C5
0558:49 6E 63 2E 00 20 AE C1 91
0560:00 00 6B 41 6C 6C 20 72 E3
0568:69 67 68 74 73 20 72 65 BB
0570:73 65 72 76 65 64 2E 00 5C
0578:A9 FF 8D 9C 09 8D 9D 09 95
0580:CE 9D 09 D0 FB A9 FF 8D 9B
0588:9D 09 CE 9C 09 D0 F1 2D D6
0590:A8 C1 05 01 01 30 00 98 71
0598:03 F8 00 20 07 30 00 98 F5
05A0:05 00 01 37 00 A1 03 01 4E
05A8:01 17 07 37 00 A1 05 09 E6
05B0:03 01 01 7F 07 37 00 A1 4B
05B8:05 00 01 58 00 88 03 0E F3
05C0:00 98 07 58 00 88 05 01 84
05C8:01 D5 00 0D 03 FB 00 1B BC
05D0:01 37 00 16 02 01 01 16 B6
05D8:00 20 AB C1 88 06 07 6F 56
05E0:19 10 20 AE C1 5C 00 93 7D
05E8:18 53 43 4F 52 45 3A 1B 68
05F0:00 20 AE C1 98 00 93 18 F8

```

```

05F8:4F 55 54 20 4F 46 3A 1B AF
0600:00 A9 00 8D A8 09 8D A9 7D
0608:09 8D 62 06 8D A8 09 8D 63
0610:A4 09 8D A5 09 8D A6 09 91
0618:8D A7 09 78 20 09 0E 20 DE
0620:53 C2 09 42 02 01 2E 01 3D
0628:A9 63 8D 9B 84 A9 6E 8D B1
0630:9C 84 58 A5 01 8D 9A 09 8D
0638:A9 35 85 01 A9 00 8D 17 A6
0640:00 AD 1E D0 AD 9A 09 85 60
0648:01 A9 91 85 02 A9 07 85 14
0650:03 A9 01 20 51 C1 A9 5D AC
0658:85 02 A9 07 85 03 20 5A 20
0660:C1 60 00 A5 3C C9 10 B0 A9
0668:03 4C EE 08 A5 3C C9 81 9A
0670:90 03 4C EE 08 A5 3B F0 3C
0678:03 4C EE 08 A5 3A C9 38 59
0680:B0 03 4C EE 08 4C CB 08 2F
0688:E5 03 88 00 00 00 30 89
0690:00 00 00 01 00 E5 03 88 D2
0698:00 00 00 00 60 00 00 00 57
06A0:01 00 E5 03 88 00 00 00 A6
06A8:00 80 00 00 00 01 00 E5 BE
06B0:03 88 00 00 00 00 60 00 21
06B8:00 00 01 00 E5 03 88 00 31
06C0:00 00 00 C8 00 00 00 01 5A
06C8:00 E5 03 88 00 00 00 03 3A
06D0:94 00 28 00 01 00 E5 03 03
06D8:00 10 00 00 35 69 00 72 EE
06E0:00 01 10 E5 03 88 00 00 D7
06E8:00 5B 5E 08 20 00 01 08 63
06F0:E5 03 88 51 00 00 0E FB EE
06F8:29 65 00 01 51 E5 03 88 B3
0700:E6 C0 00 1E 96 DD 5B 84 FA
0708:01 E6 E5 03 88 AB 40 04 B4
0710:DF EF FE AA 82 01 AB E5 E9
0718:03 88 D4 8E 42 AB B4 59 D0
0720:CD 6B 01 D4 E5 03 88 3B E4
0728:7F 83 5F 5B 4E D7 D4 01 F4
0730:3B E5 03 88 EB DF 67 BD A9
0738:E9 EF 7E 59 01 EB E5 03 23
0740:88 BF FF BD 7F E7 FF 2F 69
0748:BA 01 BF E5 03 88 DF FE 43
0750:FF 4A DF EF E7 7F 01 DF 0C
0758:00 00 00 00 00 06 90 08 AF
0760:48 4B 09 1D 88 02 10 5E 23
0768:08 11 09 08 8B 02 0B B6 91
0770:08 28 09 08 1D 02 11 AC ED
0778:09 28 09 08 68 02 11 B4 D8
0780:09 28 09 1D 1D 02 11 AC CF
0788:09 28 09 1D 68 02 11 B4 3A
0790:09 09 17 D9 00 01 01 01 EC
0798:D4 07 80 9D 07 09 42 02 9F
07A0:01 2E 01 84 CC 07 8D DC B3
07A8:07 B8 07 00 6C 08 BE 07 51
07B0:00 7B 08 C6 07 00 8A 08 60
07B8:66 61 73 74 00 00 6D 65 48
07C0:64 69 75 6D 2A 00 73 6C 85
07C8:6F 77 06 00 70 69 67 65 C9
07D0:6F 6E 73 00 6F 70 74 69 30
07D8:6E 6E 73 00 09 42 02 01 FE
07E0:2E 01 84 F7 07 08 08 08 A6
07E8:FB 07 00 1F 08 FF 07 00 F6
07F0:36 08 03 08 00 40 08 31 73
07F8:30 00 00 32 30 2A 00 35 A1
0800:30 00 00 31 30 30 00 7D
0808:AD A6 09 C9 0A B0 0D 20 A3
0810:A7 08 A9 2A 8D F9 07 A9 D9
0818:0A 8D 9E 0A 4C 5A 08 AD 8E
0820:A6 09 C9 1A B0 0D 20 A7 E1
0828:08 A9 2A 8D FD 07 A9 14 38
0830:8D 9E 0A 4C 5A 08 AD A6 A9
0838:09 C9 32 B0 0D 20 A7 08 D0
0840:A9 2A 8D 01 08 A9 32 8D 4A
0848:9E 0A 4C 5A 08 20 A7 08 71
0850:A9 2A 8D 06 08 A9 64 8D 0F
0858:9E 0A 20 90 C1 60 A9 06 30
0860:8D 5D 07 20 BD C1 20 52 F8
0868:0E 4C 02 05 20 9B 08 A9 4C
0870:2A 8D BC 07 A9 18 8D 3B 05
0878:0A 8D 1C 20 9B 08 A9 2A C1
0880:8D C4 07 A9 20 8D 3B 0A BB
0888:DA 0D 20 9B 08 A9 2A 8D CA
0890:C0 07 A9 2A 8D 3B 0A 20 2D
0898:BD C1 60 A9 00 8D BC 07 55

```

```

08A0:8D C4 07 8D CA 07 60 A9 3F
08A8:00 8D F9 07 8D FD 07 8D CB
08B0:01 00 8D 06 08 60 20 52 A9
08B8:0E 78 A9 00 8D 9B 84 8D 94
08C0:9C 84 58 A9 C0 85 2F 20
08C8:3E C2 60 AD 62 06 F0 01 9D
08D0:60 A9 01 8D 62 06 A2 00 E4
08D8:BD 84 09 9D C1 84 E8 E0 B6
08E0:14 D0 F5 A9 00 9D C1 84 07
08E8:E8 E0 40 D0 F8 60 AD 62 C1
08F0:06 D0 01 60 A9 00 8D 62 29
08F8:06 A2 00 BD 6C 09 9D C1 15
0900:84 E8 E0 18 D0 F5 A9 DD DD
0908:9D C1 84 E8 E0 40 D0 F8 1B
0910:60 96 FF FF 60 01 00 01 02
0918:80 01 87 E1 07 E1 87 E1 6E
0920:80 01 80 01 80 01 87 FF DA
0928:A2 3F F8 40 04 80 02 B8 5D
0930:2A AA 2A A8 2A BA AA A2 85
0938:AA A3 AA 80 02 40 A4 27 26
0940:F8 14 00 0A 00 06 00 0F 8F
0948:00 00 80 A0 3F FF 20 01 AF
0950:E7 E1 E3 31 E3 19 E3 19 C2
0958:E3 39 E3 E1 E3 61 E3 31 E2
0960:E3 19 E7 1D 0E 01 FF FF 84
0968:FF F8 FF F8 00 00 00 C0 01
0970:00 00 E0 00 00 F0 00 00 62
0978:F8 00 00 A0 00 00 10 00 31
0980:00 10 00 00 38 00 00 54 AC
0988:00 00 92 00 00 FE 00 00 E8
0990:92 00 00 54 00 00 30 00 A1
0998:00 00 00 00 00 00 00 00 AA
09A0:00 00 00 00 00 00 00 00 B2
09A8:00 00 00 00 A9 01 8D A2 C9
09B0:09 4C B9 09 A9 00 8D A2 2D
09B8:09 AD A8 09 F0 05 CE A8 42
09C0:09 F0 03 EE A8 09 A9 05 A4
09C8:85 08 A9 9B 85 0A A8 0E 44
09D0:85 08 20 C6 C1 AD A8 07 F1
09D8:D0 14 A9 50 85 0A 8D 9F A1
09E0:09 A9 68 85 0C 8D A0 09 28
09E8:20 CF C1 4C FF 09 A9 CE 42
09F0:85 0A 8D 9F 09 A9 68 85 39
09F8:0C 8D A0 09 20 CF C1 A9 86
0A00:00 8D 9E 09 8D 99 09 00 4E
0A08:A1 09 A9 64 8D 9C 09 A9 5E
0A10:46 8D 9D 09 CE 9C 09 D0 BA
0A18:FB A9 64 8D 9C 09 CE 9D 3E
0A20:09 D0 F1 A9 18 8D 9D 09 01
0A28:20 D2 C1 CE 9C 09 D0 00 CC
0A30:A9 64 8D 9C 09 CE 9D 09 75
0A38:D0 F1 A9 20 8D 9D 09 A5 03
0A40:39 30 14 20 9D 0C A5 01 EA
0A48:8D 9A 09 A9 35 85 01 AD F4
0A50:1E D0 AD 9A 09 85 01 AD 15
0A58:9E 09 C9 05 B0 03 4C D2 84
0A60:0A C9 0A B0 03 4C 31 0B EE
0A68:C9 12 B0 03 4C 90 00 C9 B0
0A70:18 B0 03 4C EF 0B C9 1C 3D
0A78:B0 03 4C 46 0C A9 05 85 2A
0A80:00 20 D5 C1 AD A1 09 F0 6E
0A88:07 20 EE 0C 18 EE A4 09 95
0A90:18 EE A6 09 20 40 0D EE DC
0A98:A9 09 AD A9 09 C9 14 8D 5C
0AA0:01 60 20 8D 0D A9 01 8D C8
0AA8:5D 07 A9 5D 85 02 A9 07 C6
0AB0:85 03 20 5A C1 A9 88 8D 45
0AB8:B8 84 A9 97 8D 09 84 A9 FE
0AC0:00 8D BD 84 8D BB 84 A9 46
0AC8:E8 BD BA 84 A9 F7 8D BC 59
0AD0:84 6D AD A1 09 F0 14 A9 EC
0AD8:05 85 08 A9 D7 85 0A A9 FE
0AE0:0F 85 0B 20 C6 C1 A0 00 BF
0AE8:4C FC 0A A9 05 85 00 A9 36
0AF0:9B 85 0A A9 0E 85 00 CC
0AF8:C6 C1 A0 00 AD A8 09 D0 E7
0B00:0E EE 9F 09 CE A8 09 C8 31
0B08:C0 04 D0 F5 4C 1A 0B CE A8
0B10:9F 09 CE A0 09 C8 C0 00 0D
0B18:D0 F5 EE 9E 09 AD 9F 09 23
0B20:85 0A A9 00 85 0B AD A0 05
0B28:09 85 0C 20 CF C1 4C 2B F0
0B30:0A AD A1 09 F0 14 A9 05 AB
0B38:85 0A A9 17 85 0A A9 10 71
0B40:85 0B 20 C6 C1 A0 00 4C 29

```

```

0B48:5B 0B A9 05 05 08 A9 DA CE
0B50:85 0A A9 0E 85 0B 20 C6 21
0B58:C1 A0 00 AD A8 09 D0 0E 6B
0B60:EE 9F 09 CE A0 09 C8 05 5F
0B68:04 D0 F5 4C 79 0B CE 9F 6D
0B70:09 CE A0 09 C8 04 D0 85
0B78:F5 EE 9E 09 AD 9F 09 85 2D
0B80:0A A9 00 85 0B AD A0 09 B7
0B88:85 0C 70 CF C1 4C 2B 0A 05
0B90:AD A1 09 F0 14 A9 05 85 EC
0B98:08 A9 57 85 0A A9 10 85 FC
0BA0:0B 20 C6 C1 A0 00 4C BA 91
0BA8:0B A9 05 85 0B A9 19 85 46
0BB0:0A A9 0F 85 0B 20 C6 C1 98
0BB8:A0 00 AD A8 09 D0 0E 05 F5
0BC0:9F 09 CE A0 09 C8 03 03 BC
0BC8:D0 F5 4C D8 0B CE 9F 09 B7
0BD0:CE A0 09 C8 03 D0 F5 CD
0BD8:EE 9E 09 AD 9F 09 85 0A 40
0BE0:A9 00 85 0B AD A0 09 85 B4
0BE8:0C 20 CF C1 4C 2B 0A AD F3
0BF0:A1 39 F0 12 A9 05 85 08 CD
0BF8:A9 97 85 0A A9 10 85 0B BE
0C00:20 C6 C1 4C 15 0C A9 05 08
0C08:85 0A A9 58 85 0A A9 0F 56
0C10:85 0B 20 C6 C1 AD A8 09 3D
0C18:D0 0C EE 9F 09 EE 9F 09 BF
0C20:CE A0 09 4C 2F 0C CE 9F 94
0C28:09 CE 9F 09 CE A0 09 AD B5
0C30:9F 09 0A AD A0 09 85 33
0C38:0C A9 00 85 0B 20 CF C1 53
0C40:EE 9E 09 4C 2B 0A AD A1 DB
0C48:09 F0 12 A9 05 85 0A A9 F5
0C50:D7 85 0A A9 10 85 0B 20 5E
0C58:C6 C1 4C 6C 0C A9 05 85 2B
0C60:08 A9 97 85 0A A9 0F 85 CC
0C68:0B 20 C6 C1 AD A8 09 D0 F5
0C70:0C EE 9F 09 EE 9F 09 EE C5
0C78:A0 09 4C 86 0C CE 9F 09 F8
0C80:CE 9F 09 EE A0 09 EE 9E 9D
0C88:09 AD 9F 09 85 0A AD A0 65
0C90:09 85 0C A9 10 85 0B 20 F6
0C98:CF C1 4C 2B 0A AD 05 85 DB
0CA0:10 01 60 AD 99 09 F0 01 00
0CA8:60 A5 01 8D A9 A9 35 D4
0CB0:85 01 AD 1E D0 8D 9B 09 68
0CB8:AD 1E D0 AD 9A 09 85 01 29
0CC0:AD 9B 09 F0 03 EE A1 09 E6
0CC8:EE 99 09 A9 88 85 06 A9 8A
0CD0:00 85 07 A9 00 85 09 85 BF
0CD8:0B A9 58 85 0B A9 7E 85 AD
0CE0:0A 20 2A C1 20 2A C1 AD 42
0CE8:9E 09 8D A3 09 60 AD A2 46
0CF0:09 F0 0A AD A3 09 C9 05 BF
0CF8:0B 00 4C 00 00 AD A3 09 26
0D00:C9 19 90 03 4C 08 D0 60 84
0D08:20 AE C1 82 00 48 47 52 40
0D10:45 41 54 20 53 48 4F 54 58
0D18:21 00 A9 FF 8D 9C 09 8D 76
0D20:9D 09 CE 9D 09 D0 FB A9 2C
0D28:C8 8D 9D 09 CE 9C 09 1A FE
0D30:F1 20 A8 C1 05 00 01 58 1E
0D38:00 40 03 D0 00 5A 00 60 99
0D40:20 A8 C1 05 00 01 7D 00 1C
0D48:89 03 97 00 97 01 C0 00 1D
0D50:89 03 DF 00 97 00 AD A4 A8
0D58:00 85 02 AD A5 09 85 03 D2
0D60:A9 93 85 05 A9 81 85 18 AB
0D68:A9 00 85 19 A9 C0 20 84 AE
0D70:C1 AD A6 09 85 02 AD A7 73
0D78:09 85 03 A9 93 85 05 A9 D9
0D80:C4 85 18 A9 00 85 19 A9 ED
0D88:C0 20 84 C1 60 20 C1 0D CB
0D90:A9 00 85 02 A9 0E 85 03 E3
0D98:A9 82 85 18 A9 48 85 05 D8
0DA0:A9 00 85 19 00 48 C1 AD 25
0DA8:AB 09 85 00 A9 05 85 03 07
0DB0:A9 C0 20 84 C1 A9 FE 85 54
0DB8:02 A9 0D 85 03 20 48 C1 23
0DC0:60 A9 40 2C 9E 0A F0 87 46
0DC8:AD A4 09 8D A9 09 60 A4 69
0DD0:2C 9E 0A F0 07 A9 02 8D 69
0DD8:AA 09 D0 12 A4 2C 9E 0A 10
0DE0:F0 07 A9 05 8D AA 09 D0 B4
0DE8:00 A9 0A 8D AA 09 18 AD 61
0DF0:AB 09 6D A4 09 8D AB 09 F9
0DF8:CE AA 09 D0 F1 60 25 00 AE
0E00:59 4F 55 20 48 49 54 20 79
0E08:00 20 B7 C1 40 62 1A 11 10
0E10:30 00 20 B7 C1 00 63 4B E5
0E18:11 30 00 20 B7 C1 C0 64 75
0E20:7C 11 30 00 20 B7 C1 00 28
0E28:66 AD 11 30 00 20 B7 C1 B9
0E30:40 67 DE 11 30 00 20 B7 AC
0E38:C1 80 68 0F 12 30 00 20 C4
0E40:B7 C1 C0 69 40 12 30 00 02
0E48:00 B7 C1 00 6B 71 12 30 10
0E50:00 00 20 B7 C1 1A 11 40 DC
0E58:62 30 00 20 B7 C1 4B 11 20
0E60:80 63 30 00 20 B7 C1 7C 7B
0E68:11 C0 64 30 00 20 B7 C1 7E
0E70:AD 11 00 66 30 00 20 B7 87
0E78:C1 DE 11 40 67 30 00 20 6F
0E80:B7 C1 0F 12 00 68 30 00 F1
0E88:00 B7 C1 40 12 C0 69 30 75
0E90:00 20 B7 C1 71 12 00 6B 07
0E98:30 00 60 00 00 00 00 00 D8
0EA0:00 00 00 00 00 00 00 00 BC
0EA8:00 00 00 00 00 00 00 00 C4
0EB0:00 00 00 00 00 00 00 00 D2
0EB8:C0 07 FF E0 07 FF E0 03 02
0EC0:FF C0 00 00 00 00 00 00 0D
0EC8:00 00 00 00 00 00 00 00 E4
0ED0:00 00 00 00 00 00 00 00 EC
0EE0:00 00 00 00 00 00 00 00 F4
0EE8:00 00 00 00 00 00 00 00 FC
0EF0:00 00 00 00 00 00 00 00 05
0EF8:00 00 7E 00 00 00 00 00 F4
0F00:01 FF 00 00 00 00 00 00 A5
0F08:00 00 00 00 00 00 00 00 1E
0F10:00 00 00 00 00 00 00 00 26
0F18:00 00 00 00 00 00 00 00 2E
0F20:00 00 00 00 00 00 00 00 36
0F28:00 00 00 00 00 00 00 00 3E
0F30:00 00 00 00 00 00 00 00 46
0F38:00 00 3C 00 00 7E 00 00 CF
0F40:7E 00 00 00 00 00 00 00 95
0F48:00 00 00 00 00 00 00 00 66
0F50:00 00 00 00 00 00 00 00 6E
0F58:00 00 00 00 00 00 00 00 76
0F60:00 00 00 00 00 00 00 00 7E
0F68:00 00 00 00 00 00 00 00 86
0F70:00 18 00 00 3C 00 00 00 76
0F78:00 00 00 00 00 00 00 00 96
0F80:00 00 00 00 00 00 00 00 9E
0F88:00 00 00 00 00 00 00 00 A6
0F90:00 00 00 00 00 00 00 00 AE
0F98:00 00 00 00 00 00 00 00 B6
0FA0:00 00 00 00 00 00 00 00 BE
0FAB:00 00 00 00 00 00 00 00 C6
0FBB:1C 00 00 00 00 00 00 00 DC
0FBB:00 00 00 00 00 00 00 00 D6
0FBC:00 00 00 00 00 00 00 00 DE
0FBC:00 00 00 00 00 00 00 00 E6
0FDD:00 00 00 00 00 00 00 00 EA
0FDD:00 00 00 00 00 00 00 00 37
0FEE:00 40 00 00 00 00 00 00 0F
0FF0:00 00 01 00 00 00 00 00 2F
0FF8:2E 20 01 66 40 00 00 C0 8F
0FF8:00 00 00 00 00 00 10 00 DB
1000:00 00 02 00 00 00 00 00 60
1008:40 00 00 02 00 00 00 00 68
1010:00 00 00 00 00 00 00 00 2C
1018:00 00 00 00 00 00 00 00 B8
1020:00 00 00 00 00 00 00 00 5A
1028:00 00 58 00 00 10 00 00 93
1030:89 00 00 C3 00 10 00 00 91
1038:01 00 00 00 00 00 00 00 D8
1040:00 00 00 10 00 00 00 00 81
1048:00 00 00 00 00 10 00 00 A8
1050:00 00 00 00 00 00 00 00 6C
1058:00 00 00 00 00 00 01 00 FA
1060:00 04 00 00 30 00 00 20 33
1068:00 00 00 00 10 00 00 00 D9
1070:02 00 00 20 00 00 00 00 93
1078:00 00 00 00 00 00 00 00 98
1080:20 00 00 00 02 00 00 00 C0
1088:00 00 00 00 10 00 00 00 29
1090:00 00 00 00 00 00 00 00 AC
1098:00 00 00 00 00 00 00 00 B8
10A0:00 00 00 00 00 00 00 00 C2
10A8:00 00 00 00 00 00 00 00 CA
10B0:02 00 00 04 00 00 10 00 32
10B8:00 00 00 00 20 00 00 00 D9
10C0:00 00 01 00 00 00 00 00 01
10C8:00 00 00 00 00 00 00 00 E8
10D0:00 10 00 00 00 00 00 00 FD F0
10D8:00 00 00 00 00 00 00 00 F8
10E0:00 00 00 00 00 00 00 00 81
10E8:00 00 00 00 00 00 00 00 09
10F0:00 00 04 00 00 00 00 00 51
10F8:00 01 00 00 00 00 00 00 61
1100:00 00 00 00 00 00 00 00 22
1108:00 00 00 00 00 00 20 00 6A
1110:00 00 00 00 00 00 00 00 32
1118:00 FD 00 00 00 00 00 00 B9

```

Program 2: Geo-Converter

```

HE 10 REM COPYRIGHT 1988 COMPU
TE! PUBLICATIONS, INC. -
ALL RIGHTS RESERVED
PR 20 POKE 53280,0:POKE 53281,
0:POKE 646,5:PRINTCHR$(1
42);CHR$(147)
SX 30 FOR I=1 TO 10:PRINT "{DOWN}"
:NEXT
JJ 40 PRINTTAB(5)"{4}UDI COPYR
IGHT 1988"
DJ 50 PRINTTAB(5)"GCH COMPUTE!
PUBLICATIONS INC."
FJ 60 PRINTTAB(5)"JEK ALL RIGH
TS RESERVED{HOME}"
XP 70 PRINT "{DOWN}{RVS}{B}GEOC
ONVERTER 1.1{OFF}{DOWN}
{GRN}"
FM 80 INPUT "FILE TO CONVERT";G
FS
PS 90 PRINT "{DOWN}SEARCHING FO
R "GFS"
HA 100 HD$="":FOR I=1 TO 4:REA
D HE:HD$=HD$+CHR$(HE):N
EXT
KK 110 FOR I=1 TO 5:READIE:ID$=I
D$+CHR$(IE):NEXT
MD 120 NL$="":TS=CHR$(18):SS=C
HR$(1):OPEN 15,8,15,"I0
":"OPEN 2,8,2,"#"
CR 130 GOSUB360:GET #2,NT$,NS$
FB 140 FOR E=0 TO 7
JX 150 D$=NL$:GET#2,B$:I=1:IFB
$=NL$ THEN210
HR 160 IF ASC(B$)<>130 THEN210
PM 170 GET#2,HT$,HS$:I=3:IF HS
$="" THEN HS$=CHR$(0)
BG 180 GET#2,B$:I=I+1:IF B$=""
THEN B$=CHR$(0)
GH 190 IF ASC(B$)=160 THEN210
BR 200 D$=D$+B$:GOTO180
BK 210 FOR I=1 TO 31:GET#2,B$:
NEXT
FK 220 IF D$=GFS THEN250
AA 230 NEXT E:IF NT$=NL$ THEN2
50
GR 240 TS=NT$:SS=NS$:GOTO130
JS 250 IF D$=NL$ THENPRINT"
{DOWN}{RVS}FILE NOT FOU
ND{OFF}":GOTO350
GJ 260 PRINT "{DOWN}CONVERTING
{SPACE}"GFS"
JR 270 DT$=T$:DS$=S$:TS=HT$:SS
=HS$:GOSUB360
SA 280 GET#2,MT$,MSS$:IF MSS$=""
THEN MSS$=CHR$(0)
JM 290 FOR I=0 TO 65:GET #2,B$
:NEXT
XA 300 GET#2,CT$,GT$:GOSUB360:
PRINT#2,HD$;:GOSUB370:T
$=DT$:SS=DS$:GOSUB360
KP 310 FOR I=0 TO 32*B+2:GET#2
,B$:NEXT
KQ 320 PRINT#2,MT$,MSS$;:FOR I=0
TO 15:GET#2,B$:NEXT

```



```

MQ 330 PRINT#2,HT$;H$S;CHR$(0)
;GTS;
QJ 340 PRINT#2,ID$;:GOSUB370:P
RINT:PRINTGFS" CONVERTE
D"
AS 350 CLOSE2:CLOSE15:END
QC 360 U$="01":GOTO380
KQ 370 U$="02"
QE 380 PRINT#15,U$;2;0;ASC(T$+
"0");ASC(S$+"0")
PX 390 RETURN
BP 400 DATA 0,255,3,21,87,10,1
,0,0

```

Mob Maker

See instructions in article on page 60 before typing in.

```

0001:0C 08 24 04 9E 32 31 30 2E
0009:32 3A 00 2E 08 2E 1A 43 E7
0011:4F 50 59 52 49 47 48 54 79
0019:20 31 39 38 38 20 43 4F 48
0021:4D 50 55 54 45 21 20 50 1B
0029:55 42 4C 2E 00 34 08 38 F9
0031:04 00 00 00 00 AD 11 00 0D
0039:29 EF 0D 11 D0 A9 FF 05 4F
0041:37 A9 7F 85 38 AD 00 DD F5
0049:29 FC 09 01 8D 00 DD AD 34
0051:18 D0 29 0F 8D 18 D0 A9 CF
0059:80 8D 88 02 20 49 19 93 2A
0061:08 0E 00 AD 11 D0 09 10 E1
0069:8D 11 D0 A9 0F 8D 11 D0 F8
0071:8D 21 D0 A9 06 8D 11 D0 CB
0079:A9 C1 8D 18 03 A2 01 8E 35
0081:01 1C CA 86 05 8E 0C 1C 71
0089:8E 0D 1C A9 00 8D 8A 02 93
0091:A9 15 A2 FF A0 10 20 8C 22
0099:16 A0 00 A2 01 8C 23 1C A3
00A1:8E 22 1C AE 22 1C AC 23 ED
00A9:1C B9 4F 1C 18 69 0B 48 A6
00B1:C0 B9 4F 1C 8C 23 1C AC 12
00B9:68 20 8C 16 EE 23 1C AC E1
00C1:23 1C B9 4F 1C A8 A9 0D 7A
00C9:AE 22 1C 20 8C 16 EE 23 FC
00D1:1C 0E 22 1C D0 CD A9 00 8A
00D9:A2 FF A0 01 20 00 16 AD 6C
00E1:02 1C 8D 86 02 A9 01 48 15
00E9:20 81 19 68 18 0A D0 F7 96
00F1:AD 0C 1C F0 03 4C F1 09 A4
00F9:AD 86 02 20 6C 19 A9 80 60
0901:85 FE A9 A0 85 F0 A5 05 49
0909:F0 06 A9 F7 8D 03 1C 2C A6
0911:A9 D0 8D 03 1C A2 00 A0 1A
0919:00 AD 03 1C 91 FD C8 AD 7C
0921:04 1C 91 FD C8 C0 18 D0 98
0929:F0 18 A5 FD C8 28 85 FD 43
0931:A5 FE 69 00 85 FE E8 E0 DD
0939:15 D0 DC AD 0C 1C F0 03 36
0941:4C F1 09 AD 01 1C A0 00 AB
0949:6A B0 03 C8 D0 FA B9 27 B6
0951:D0 8D 20 D0 8D 05 1C 20 19
0959:CF 19 20 D0 19 C6 01 78 89
0961:A0 00 A9 15 8D 08 1C A9 B8
0969:03 8D 07 1C A2 08 A9 00 8B
0971:8D 06 1C B1 FB 48 A5 05 BB
0979:F0 07 CA 68 0A 2E 06 1C D6
0981:48 CA 68 0A 2E 06 1C 48 22
0989:98 48 A0 0A A5 05 D0 11 02
0991:AD 06 1C D0 06 AD 86 02 82
0999:4C C9 09 AD 05 1C 4C C9 3B
09A1:09 AD 06 1C D0 06 AD 86 A6
09A9:02 4C C4 09 C9 01 D0 06 F2
09B1:AD 25 D0 4C C4 09 C9 02 A2
09B9:D0 06 AD 05 1C 4C C4 09 60
09C1:AD 26 D0 91 FD 20 93 1A 19
09C9:91 FD 20 93 1A 8C 06 1C 8C
09D1:68 AB 68 E0 00 D0 9E C8 A6
09D9:CE 07 1C D0 8F A9 10 20 09
09E1:87 1A CE 08 1C F0 03 4C 8F
09E9:68 09 E6 01 50 20 78 1A AD
09F1:A0 00 8C 77 02 84 C6 A9 B6
09F9:01 8D 0D 1C AD 01 1C 20 1D

```

```

0A01:81 19 A4 05 AE 21 D0 B1 4E
0A09:FD 48 8A 91 FD 88 F0 FA 87
0A11:20 67 1A A9 00 8D 0D 1C 59
0A19:AD 01 1C 20 81 19 A4 05 88
0A21:68 91 FD 88 F0 FB 20 67 35
0A29:1A 20 67 1A AD 77 02 F0 21
0A31:03 4C 4B 0B AD 00 DC 49 64
0A39:7F F0 B5 AD 00 DC 49 7F 60
0A41:C9 10 D0 03 4C D3 0A 6A B8
0A49:90 0A CE 0B 1C 10 05 A2 00
0A51:14 8E 0B 1C 6A 90 0F EE D8
0A59:0B 1C AE 0B 1C E0 15 90 9F
0A61:05 A2 00 8E 0B 1C 6A 90 B7
0A69:19 CE 0A 1C A6 05 F0 03 EE
0A71:CE 0A 1C AE 0A 1C 10 0A C8
0A79:A2 16 A4 05 D0 01 E8 8E 34
0A81:0A 1C 6A 90 16 EE 0A 1C 94
0A89:A6 05 F0 03 EE 0A 1C AE 07
0A91:0A 1C E0 18 D0 05 A2 00 2F
0A99:8E 0A 1C 48 20 CF 19 20 12
0AA1:D0 19 A0 00 AE 0A 1C F0 43
0AA9:10 20 93 1A C8 C0 08 D0 0C
0AB1:05 20 A6 1A A0 00 CA D0 32
0AB9:F0 AE 0B 1C F0 0D A9 28 4C
0AC1:20 07 1A A9 03 20 9A 1A 8D
0AC9:CA D0 F3 68 6A B0 03 4C E4
0AD1:F1 09 A4 05 AD 20 D0 91 27
0AD9:FD 88 10 FB AD 20 D0 A6 07
0AE1:05 F0 14 29 0F CD 86 02 88
0AE9:F0 1D AD 20 D0 CD 25 D0 4E
0AF1:F0 0F CD 26 D0 F0 D0 29 EB
0AF9:0F CD 86 02 F0 09 A9 80 79
0B01:2C A9 40 2C A9 C0 2C A9 B4
0B09:00 8D 06 1C AD 0A 1C 29 FB
0B11:07 A6 05 F0 17 4A AA 8D F8
0B19:1A 1C 8D 1E 1C 8A F0 1C DF
0B21:4E 06 1C 4E 06 1C CA D0 4F
0B29:F7 4C 3D 08 AA BD 12 1C 33
0B31:8D 1E 1C 8A F0 06 4E 06 04
0B39:1C CA D0 FA 20 5C 1A 2D AD
0B41:1E 1C D0 06 1C 91 FB 4C DA
0B49:2A 0A A0 00 D9 7F 1C F0 01
0B51:08 C8 C0 30 D0 F6 4C F1 A5
0B59:09 98 0A A8 B9 AF 1C 8D 38
0B61:6A 08 B9 B0 1C 8D 6B 0A AA
0B69:4C FF FF 20 D8 19 A0 3F 53
0B71:A9 00 91 FB 88 10 FB 4C 17
0B79:3C 09 20 B7 0B 4C 3C 09 7A
0B81:20 D6 0B 4C 3C 09 AD 01 E5
0B89:1C 48 A9 01 8D 01 1C 20 CD
0B91:B7 0B 0E 01 1C D0 F8 6B 96
0B99:8D 01 1C 4C 3C 09 AD 01 61
0BA1:1C 48 A9 01 8D 01 1C 20 E5
0BA9:D6 0B 0E 01 1C D0 F8 6B 3E
0BB1:8D 01 1C 4C 3C 09 AE 01 7B
0BB9:1C 20 AD 1A A0 01 C9 10 E9
0BC1:D0 02 A0 11 A9 0C 2C A9 5D
0BC9:09 AE 01 1C 20 8C 16 AD FE
0BD1:01 1C 4C 81 19 AE 01 1C B2
0BD9:20 AD 1A A0 01 C9 FF D0 B8
0BE1:E6 A0 11 D0 E2 A9 01 2C AE
0BE9:A9 02 2C A9 04 2C A9 88 A1
0BF1:2C A9 10 2C A9 20 2C A9 1D
0BF9:40 2C A9 80 8D 01 1C 2D 4E
0C01:1C D0 D0 03 A9 00 2C A9 F4
0C09:01 85 05 4C 9A 08 AD 01 B9
0C11:1C 4D 1D D0 8D 1D D0 4C 0A
0C19:F1 09 AD 0F 1C 49 FF 8D A6
0C21:0F 1C 8D 1D D0 4C F1 09 EF
0C29:AD 10 1C 49 FF 8D 10 1C A6
0C31:8D 17 D0 4C F1 09 AD 01 C4
0C39:1C 4D 17 D0 8D 17 D0 4C 59
0C41:F1 09 AD 01 1C 4D 1C D0 79
0C49:8D 1C D0 A5 05 49 01 85 78
0C51:05 4C F1 08 AD 11 1C 49 F0
0C59:F0 8D 11 1C 8D 1C D0 A5 DC
0C61:05 49 01 85 05 4C F1 08 0C
0C69:EE 21 D0 4C F1 09 AD 86 B5
0C71:02 4C 8C 0C A6 05 F0 16 31
0C79:AD 25 D0 4C 8C 0C AD 05 85
0C81:1C 4C 8C 8C A6 05 F0 06 3E
0C89:AD 26 D0 8D 20 00 4C F1 C3
0C91:09 A5 05 8D 21 1C 20 BE 89
0C99:1A A0 02 A2 00 89 A7 82 89
0CA1:4A 08 2A 28 7E A7 02 E8 28

```

```

0CA9:7E A7 02 E8 7E A7 02 E8 39
0CB1:C8 C8 C8 C0 41 D0 E6 A0 41
0CB9:3F B9 A7 02 91 FB 88 10 92
0CC1:F8 CE 21 1C 10 D0 4C 3C 88
0CC9:09 A5 05 8D 21 1C 20 D8 DB
0CD1:19 A2 15 20 5C 1A 2A 08 6B
0CD9:A0 02 20 5E 1A 28 2A 08 7A
0CE1:91 FB 88 10 F5 28 A9 03 7A
0CE9:20 9A 1A CA D0 E5 CE 21 85
0CF1:1C 10 DB 4C 3C 09 20 BE 61
0CF9:1A A0 00 B9 AA 02 91 FB 5F
0D01:C8 C0 3C D0 F6 A2 00 BD 44
0D09:A7 02 91 FB C8 E8 00 03 18
0D11:D0 F5 4C 3C 09 20 BE 1A 8E
0D19:A0 3B B9 A7 02 C8 C8 C8 91
0D21:91 FB 88 88 88 88 10 F2 16
0D29:20 D8 19 A0 02 B9 E3 02 77
0D31:91 FB 88 10 F8 4C 3C 09 9F
0D39:20 D8 19 A0 3F 20 5E 1A 18
0D41:49 FF 91 FB 88 10 F6 4C 80
0D49:3C 09 20 BE 1A A0 3E 8C 10
0D51:23 1C A2 02 0E 22 1C B9 67
0D59:A7 02 AC 22 1C 91 FB CE 6D
0D61:23 1C 30 0F AC 23 1C CE 04
0D69:22 1C 10 EB A9 03 20 9A 90
0D71:1A D0 DF 4C 3C 09 20 BE 92
0D79:1A A9 15 A2 00 A0 18 1E A8
0D81:A9 02 3E A8 02 3E A7 02 9D
0D89:6E 21 1C 6E 22 1C 6E 23 0F
0D91:1C 88 D0 EB A5 05 D0 03 9A
0D99:4C 29 0E A0 04 A9 00 8D 44
0DA1:1E 1C 2E 21 1C 2E 1E 1C 9B
0DA9:2E 21 1C 2E 1E 1C AD 1E 64
0DB1:1C 29 03 F0 0C C9 03 F0 12
0DB9:08 AD 1E 1C 49 03 8D 1E 58
0DC1:1C 88 D0 DE AD 1E 1C 8D BF
0DC9:21 1C A0 04 A9 00 8D 1E 56
0DD1:1C 2E 22 1C 2E 1E 1C 2E DB
0DD9:22 1C 2E 1E 1C AD 1E 1C A3
0DE1:29 03 F0 0C C9 03 F0 08 74
0DE9:AD 1E 1C 49 03 8D 1E 1C 21
0DF1:88 D0 DE AD 1E 1C 8D 22 D9
0DF9:1C A0 04 A9 00 8D 1E 1C F3
0E01:2E 23 1C 2E 1E 1C 2E 23 44
0E09:1C 2E 1E 1C AD 1E 1C 29 8B
0E11:03 F0 0C C9 03 F0 08 AD A2
0E19:1E 1C 49 03 8D 1E 1C 88 4A
0E21:D0 DE AD 1E 1C 8D 23 1C 6E
0E29:AD 21 1C 91 FB C8 AD 22 81
0E31:1C 91 FB C8 AD 23 1C 91 8F
0E39:FB A9 03 20 9A 1A E8 E8 18
0E41:E8 E0 3F B0 03 4C 7E 0D 50
0E49:4C 3C 09 20 D8 19 A0 3F 69
0E51:20 5E 1A 99 3D 03 88 10 09
0E59:F7 20 D2 0F 4C F1 0B 20 1F
0E61:D8 19 A0 3F B9 3D 03 91 92
0E69:FB 88 10 F8 4C 3C 09 20 BC
0E71:F5 19 A0 04 A2 09 20 B4 51
0E79:1A 20 49 19 43 48 41 4E 71
0E81:47 45 20 43 4F 4C 4F 52 67
0E89:20 4F 46 00 20 4F 1A 20 E4
0E91:49 19 20 31 3D 42 41 43 68
0E99:4B 47 52 4F 55 4E 44 00 D8
0EA1:20 4F 1A A5 05 F0 15 20 75
0EA9:49 19 20 32 3D 4D 2E 43 96
0EB1:2E 23 30 2A 5B 30 31 5D 11
0EB9:00 20 4F 1A 20 49 19 20 E1
0EC1:33 3D 53 50 52 49 54 45 DB
0EC9:20 43 4F 4C 4F 52 00 20 59
0ED1:4F 1A A5 05 F0 15 20 49 86
0ED9:19 20 34 3D 4D 2E 43 2E BC
0EE1:23 31 20 5B 31 31 5D 00 9E
0EE9:20 4F 1A 20 49 19 20 52 70
0EF1:45 54 55 52 4E 20 3D 20 23
0EF9:45 58 49 54 20 00 20 E4 63
0F01:FF F0 FB C9 0D D0 03 4C 75
0F09:F1 08 38 E9 31 30 EF C9 BB
0F11:05 B0 EB 48 A6 05 D0 0C D6
0F19:C9 01 F0 04 C9 03 D0 04 BA
0F21:68 4C FF 0E A0 04 A2 09 CA
0F29:20 B4 1A 20 97 0F 20 49 4C
0F31:19 20 20 20 20 20 45 4E 44
0F39:54 45 52 20 20 20 20 01
0F41:20 00 20 4F 1A 20 49 19 65
0F49:20 20 20 43 4F 4C 4F 52 54

```

0F51:20	4B	45	59	20	20	20	20	72	11F9:20	5C	1A	91	FD	20	A6	1A	77	14A1:C9	01	F0	0E	20	58	15	A9	24
0F59:00	20	4F	1A	20	97	0F	20	A8	1201:20	93	1A	A5	FE	C9	C0	D0	29	14A9:FF	0D	20	1C	20	62	15	20	CF
0F61:E4	FF	A0	0F	D9	24	1C	F0	7F	1209:03	4C	F1	08	A5	FC	CD	1F	5C	14B1:4F	1A	20	49	19	4E	41	4D	72
0F69:05	88	10	F8	D0	F1	68	D0	AD	1211:1C	D0	E5	A5	FB	CD	1E	1C	FD	14B9:45	F7	52	45	54	55	52	4E	09
0F71:06	8C	86	02	4C	F1	08	C9	AA	1219:D0	DE	4C	F1	08	A0	17	B9	B0	14C1:3D	45	58	49	54	00	20	4F	AB
0F79:01	D0	06	8C	25	D0	4C	F1	CC	1221:67	1C	99	4F	1C	88	10	F7	43	14C9:1A	20	12	14	A5	06	F0	05	B6
0F81:08	C9	03	D0	06	8C	26	11	03	1229:4C	9A	08	D0	F5	19	A2	09	7F	14D1:C9	02	D0	4C	60	AD	39	1C	86
0F89:4C	F1	08	A9	0E	AE	01	1C	2F	1231:A0	04	20	B4	1A	20	49	19	F2	14D9:20	DE	19	A5	FB	85	FD	A5	DE
0F91:20	8C	16	4C	F1	08	A9	02	6F	1239:20	44	41	54	41	20	53	54	71	14E1:FC	05	FE	AE	3A	1C	E8	8A	53
0F99:8D	21	1C	20	49	19	20	20	5B	1241:41	54	40	45	4E	54	53	00	83	14E9:20	DE	19	A9	01	A0	FF	A2	C4
0FA1:20	20	20	20	20	20	20	20	8F	1249:20	4F	1A	20	4F	1A	A9	00	CC	14F1:08	20	BA	FF	AD	22	1C	A2	4E
0FA9:20	20	20	20	20	20	20	20	87	1251:0D	36	1C	8D	37	1C	A9	02	A5	14F9:3C	A0	1C	20	BD	FF	A9	00	2F
0FB1:4F	1A	CE	21	1C	D0	E4	60	38	1259:05	06	20	A8	14	AC	22	1C	04	1501:A2	FF	A0	00	20	8C	16	A6	96
0FB9:A9	01	8D	0C	1C	AD	21	D0	0A	1261:A9	2C	99	3C	1C	A9	50	99	1E	1509:FB	A4	FC	A9	FD	C6	01	20	C1
0FC1:0D	06	02	20	6C	19	4C	F1	DC	1269:3D	1C	A9	2C	99	3E	1C	A9	02	1511:D0	FF	E6	01	A9	00	A2	FF	27
0FC9:99	A9	00	8D	0C	1C	4C	0A	F9	1271:57	99	3F	1C	A9	00	A2	FF	E3	1519:A0	01	20	8C	16	4C	F1	08	6E
0FD1:08	20	F5	19	A0	08	A2	0A	C0	1279:A0	00	20	8C	16	A9	02	A2	B8	1521:A9	01	A2	08	A0	00	20	BA	35
0FD9:20	B4	1A	20	49	19	43	55	05	1281:08	A0	01	20	BA	FF	AD	22	47	1529:FF	AD	22	1C	A2	3C	A0	1C	28
0FE1:52	52	45	4E	54	00	20	4F	7D	1289:1C	18	69	03	A2	3C	A0	1C	82	1531:20	BD	FF	A9	00	A2	FF	A0	00
0FE9:1A	20	49	19	44	41	54	41	E8	1291:20	BD	FF	20	C0	FF	A2	02	84	1539:00	20	8C	16	A9	00	A2	00	F0
0FF1:00	49	53	00	20	4F	1A	20	6F	1299:20	C9	FF	A9	01	20	D2	FF	09	1541:A0	84	20	D5	FF	A9	00	A2	87
0FF9:49	19	20	53	41	56	45	44	6E	12A1:A9	08	20	D2	FF	A9	1F	85	38	1549:FF	A0	01	20	8C	16	AD	0E	E3
1001:00	20	6F	1A	A2	08	8E	22	29	12A9:FD	A9	1D	05	FE	AD	39	1C	70	1551:1C	FC	01	60	4C	F1	08	AD	D3
1009:1C	20	4F	1A	CE	22	1C	D0	D5	12B1:20	DE	19	20	C1	1A	A2	00	7E	1559:00	D0	49	FF	29	1D	D0	F7	07
1011:F8	4C	F1	08	20	F5	19	18	A2	12B9:8E	22	1C	A2	08	8E	08	1C	02	1561:60	A9	10	8D	1E	1C	8D	1F	9C
1019:A0	06	A2	0A	8C	23	1C	8E	B7	12C1:A2	08	8E	07	1C	EE	36	1C	A0	1569:1C	A0	49	19	20	53	54	41	9C
1021:22	1C	20	F0	FF	20	49	19	00	12C9:D0	03	EE	37	1C	A2	00	BD	91	1571:52	54	20	20	3E	00	A9	0B	30
1029:45	50	49	54	20	50	52	4F	A6	12D1:34	1C	20	0B	14	E8	E0	05	D6	1579:8D	58	13	20	56	13	8D	39	38
1031:47	52	41	4D	08	20	4F	1A	BF	12D9:D0	F5	AE	22	1C	20	CD	13	EB	1581:1C	8D	1F	1C	20	58	15	20	6F
1039:20	4F	1A	20	49	19	41	52	06	12E1:A9	2C	20	08	14	E8	CE	07	83	1589:4F	1A	20	49	19	20	45	4E	9C
1041:45	20	59	4F	55	20	53	55	53	12E9:1C	D0	F2	A4	FD	D0	02	C6	F6	1591:44	20	20	20	20	3E	00	EE	D4
1049:52	45	00	20	4F	1A	20	49	52	12F1:FE	C6	FD	A9	00	20	0B	14	4C	1599:58	13	20	56	13	8D	3A	1C	7D
1051:19	20	20	20	20	59	2F	4E	1F	12F9:8E	22	1C	CE	08	1C	D0	C0	71	15A1:60	A0	05	A9	00	9D	1F	1D	21
1059:00	A9	00	85	C6	20	E4	FF	BC	1301:A9	FF	20	0B	14	A0	00	A9	7D	15A9:88	D0	FA	A9	24	8D	3C	1C	32
1061:F0	FB	C9	59	F0	03	4C	F1	E5	1309:1F	85	FD	A9	1D	85	FE	A0	18	15B1:A9	01	8D	22	1C	A9	20	85	12
1069:08	A9	04	8D	88	02	4C	66	9C	1311:00	B1	FD	C9	FF	F0	0B	20	F9	15B9:FB	8D	40	15	A9	1D	85	FC	68
1071:FE	20	F5	19	A2	09	A0	07	EA	1319:D2	FF	E6	FD	D0	F1	E6	FE	80	15C1:8D	42	15	A9	01	8D	0E	1C	F6
1079:20	B4	1A	20	49	19	20	20	2B	1321:D0	ED	EE	39	1C	AD	39	1C	C2	15C9:20	21	15	A9	20	85	2B	A9	A0
1081:43	48	41	4E	47	45	00	D0	D1	1329:CD	3A	1C	F0	02	B0	03	4C	7C	15D1:1D	85	2C	20	33	A5	A9	01	F7
1089:4F	1A	20	49	19	20	20	43	3D	1331:AE	12	A2	03	8E	22	1C	A9	92	15D9:85	2B	A9	08	85	2C	CE	0E	CF
1091:55	52	53	4F	52	00	20	4F	72	1339:00	20	D2	FF	CE	22	1C	D0	C9	15E1:1C	A9	00	8D	40	15	A9	84	8B
1099:1A	20	49	19	20	20	53	50	02	1341:FE	A9	02	20	C3	FF	20	CC	BA	15E9:8D	42	15	20	F5	19	A9	05	7C
10A1:45	45	44	2E	00	20	4F	1A	5A	1349:FF	A9	00	A2	FF	A0	01	20	AB	15F1:8D	21	1C	A2	09	A0	04	20	CB
10A9:20	4F	1A	20	49	19	20	20	02	1351:8C	16	4C	F1	08	18	A2	0A	DB	15F9:84	1A	20	49	19	20	20	20	47
10B1:31	20	2D	2D	20	39	00	20	F0	1359:A0	0F	20	F0	FF	20	67	1A	10	1601:44	49	52	45	43	54	4F	52	9C
10B9:4F	1A	20	49	19	46	41	53	58	1361:20	67	1A	20	E4	FF	C9	0D	7E	1609:59	00	20	4F	1A	A0	00	B1	DF
10C1:54	2D	20	53	4C	4F	57	11	80	1369:D0	07	68	68	68	68	4C	F1	BC	1611:FB	D0	08	C8	C0	02	D0	F7	A4
10C9:20	E4	FF	C9	31	90	F9	C9	59	1371:08	C9	91	F0	3A	C9	11	F0	5B	1619:4C	82	16	A0	00	B1	FB	85	1D
10D1:3A	B0	F5	29	0F	8D	09	1C	69	1379:33	C9	9D	F0	2C	C9	1D	F0	22	1621:FD	C8	B1	FB	85	FE	F0	59	D7
10D9:4C	F1	08	AE	01	1C	20	AD	EE	1381:25	C9	20	F0	43	AD	00	DC	6D	1629:10	F8	69	04	85	FB	A5	B4	
10E1:1A	8D	3A	1C	A9	FE	8D	39	19	1389:49	FF	29	1F	C9	10	F0	38	14	1631:FC	69	00	85	FC	A0	00	B1	AA
10E9:1C	AD	39	1C	20	D5	19	18	33	1391:C9	01	F0	1B	C9	02	F0	14	F8	1639:FB	F0	46	C8	C9	22	D0	F7	65
10F1:A5	FB	69	40	85	FD	A5	FC	81	1399:C9	04	F0	0D	C9	08	F0	06	EA	1641:18	98	65	FB	85	FB	A5	FC	70
10F9:69	00	85	FE	A0	3F	20	5E	10	13A1:AD	1E	1C	4C	C3	13	A9	F6	23	1649:69	00	85	FC	A0	00	B1	FB	0F
1101:1A	91	FD	88	10	FB	CE	39	18	13A9:2C	A9	0A	2C	A9	FF	2C	A9	A3	1651:C9	22	F0	B0	20	D2	FF	E6	EC
1109:1C	AD	39	1C	CD	3A	1C	B0	CD	13B1:01	18	6D	1E	1C	CD	1F	1C	60	1659:FB	D0	F1	E6	FC	D0	ED	A5	11
1111:D8	4C	6C	0B	20	F5	19	A2	9E	13B9:90	A9	CD	20	1C	B0	44	8D	C8	1661:FD	85	FB	A5	FE	85	FC	F0	C0
1119:09	A0	09	20	B4	1A	20	49	A2	13C1:1E	1C	20	B3	19	4C	56	13	F6	1669:18	CE	21	1C	D0	9C	A9	00	87
1121:19	44	45	4C	45	54	45	00	54	13C9:AD	1E	1C	60	A9	00	8D	1E	5E	1671:85	C6	20	E4	FF	F0	FB	C9	E9
1129:20	4F	1A	20	49	19	20	54	B7	13D1:1C	8D	1F	1C	BD	A7	02	A8	48	1679:8D	F0	03	4C	EC	15	4C	F1	D3
1131:40	49	53	00	20	4F	1A	20	C6	13D9:78	F8	C8	88	F0	14	18	A9	CD	1681:00	20	E4	FF	C9	D0	D0	F9	74
1139:49	19	53	50	52	49	54	45	5B	13E1:01	6D	1E	1C	8D	1E	1C	A9	30	1689:4C	F1	08						


```

1749:26 02 D0 CE 68 68 85 02 04
1751:AD 0C 03 AE D0 03 AC 0E 80
1759:03 60 C9 06 D0 35 A5 03 64
1761:48 A5 02 48 84 03 A0 01 54
1769:84 02 88 8A F0 1E 4A AA 53
1771:90 13 38 B9 F0 D0 E5 03 61
1779:99 00 D0 B0 00 AD 10 D0 01
1781:45 02 8D 10 D0 C8 C8 18 D0
1789:26 02 00 DE 68 85 02 68 21
1791:85 03 00 C9 07 D0 1A 98 34
1799:48 A0 00 8A F0 11 4A AA C7
17A1:90 09 68 48 18 79 01 D0 65
17A9:99 01 D0 C8 C8 D0 EC 68 57
17B1:60 C9 08 D0 1E A5 02 48 64
17B9:84 02 A0 00 8A F0 10 4A 41
17C1:AA 90 08 B9 01 D0 E5 02 1F
17C9:99 01 D0 C8 C8 D0 ED 68 79
17D1:85 02 60 C9 00 F0 00 C9 D7
17D9:15 D0 4A A5 04 48 A9 00 FE
17E1:F0 05 A5 04 48 A9 FF 85 2D
17E9:04 A5 03 48 A5 02 48 18 46
17F1:AD 88 02 69 03 85 03 A9 CD
17F9:F0 85 02 98 48 A0 00 A9 1F
1801:F0 18 4A AA 90 11 18 A5 42
1809:04 D0 06 68 48 90 06 D0 99
1811:04 68 48 71 02 91 02 C8 A0
1819:D0 E5 00 68 85 02 00 85 49
1821:03 68 85 04 60 C9 0A F0 0D
1829:04 C9 14 D0 39 A5 04 48 0E
1831:A5 03 48 A5 02 48 18 AD 67
1839:88 02 69 03 85 03 A9 F0 10
1841:85 02 84 04 A0 00 8A F0 90
1849:10 4A AA 90 09 B1 02 E5 6B
1851:04 91 02 8D 0C 03 C8 D0 CF
1859:ED 68 85 02 68 85 03 68 33
1861:85 00 AD 0C 03 60 C9 0B 04
1869:D0 2B A5 02 48 98 48 A0 77
1871:FE 84 00 A0 00 8A F0 18 B0
1879:4A AA 90 D0 68 48 99 00 F3
1881:D0 AD 10 D0 25 02 00 10 F0
1889:D0 C8 C8 38 26 00 B0 E5 71
1891:68 68 85 02 60 C9 0C D0 F3
1899:2A A5 02 48 98 48 A0 01 35
18A1:84 02 88 8A F0 18 4A AA 75
18A9:90 D0 68 48 00 D0 AD 13
18B1:10 00 05 02 8D 10 D0 C8 F5
18B9:C8 18 26 02 90 E5 68 68 8E
18C1:85 02 00 C9 D0 B0 16 98 4E
18C9:48 A0 00 8A F0 00 4A AE 9
18D1:90 05 68 48 99 01 D0 C8 58
18D9:C8 D0 F0 68 60 C9 0E D0 5E
18E1:15 98 48 A0 00 8A F0 00 ED
18E9:4A AA 90 05 00 48 99 27 0B
18F1:D0 C8 D0 F1 68 60 C9 0F 5D
18F9:D0 04 8C 25 D0 60 C9 10 23
1901:D0 04 8C 26 D0 60 C9 11 00
1909:D0 04 AD 1E D0 60 C9 12 E9
1911:D0 00 00 1F D0 60 C9 16 00
1919:D0 2B A0 00 8D 15 D0 0D A3
1921:1C D0 8D 1D 8D 8D 17 0D 04
1929:A0 10 99 00 D0 00 10 FA A6
1931:A0 00 99 27 D0 88 10 FA 1F
1939:8D 25 D0 8D 26 D0 AD 1E 5C
1941:D0 AD 1F D0 60 A9 FF 60 42
1949:68 8D 6A 19 AA 68 00 6F 6F
1951:19 A8 E8 D0 01 C8 8A 00 C4
1959:1E 00 00 98 6D 6A 19 00 00
1961:A9 00 6D 6B 19 48 8A 48 14
1969:60 00 00 A0 00 AD 86 02 9B
1971:99 00 00 99 00 D9 99 00 BF
1979:DA 99 00 DB C8 D0 F1 00 0B
1981:48 8D 21 1C 18 A2 03 A0 13
1989:04 20 F0 FF 4E 21 1C B0 C3
1991:0F 38 20 F0 FF C8 C8 C8 E9
1999:C8 18 20 F0 FF 4C 00 19 AE
19A1:68 AA 20 AD 1A AE 00 1C 53
19A9:F0 08 20 49 19 20 20 20 98
19B1:00 60 C9 64 B0 12 48 A9 83
19B9:38 20 D2 FF 00 C9 A0 B0 95
19C1:07 48 A9 30 20 D2 FF 68 76
19C9:AA A9 00 4C CD 00 A9 D8 12
19D1:85 FE A9 A0 85 FD 60 AE 59
19D9:01 1C 20 AD 1A A2 06 85 5F
19E1:FB A9 00 85 FC 06 FB 26 F2
19E9:FC CA D0 F9 18 A9 80 65 D4

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19F1:FC 85 FC 60 A0 00 A2 08 08
19F9:20 B4 1A 20 49 19 D5 C3 CC
1A01:C3 C3 C3 C3 C3 C3 C3 C3
1A09:C3 C3 C3 C3 C3 C3 C3 C3
1A11:00 A9 06 8D 21 1C 20 4F 52
1A19:1A 20 49 19 D0 20 20 20 EC
1A21:20 20 20 20 20 20 20 55
1A29:20 20 20 20 20 20 20 C2
1A31:21 1C D0 E2 20 4F 1A 20 D7
1A39:49 19 CA C3 C3 C3 C3 C3 66
1A41:C3 C3 C3 C3 C3 C3 C3 75
1A49:C3 C3 C3 CB 00 68 EE 22 07
1A51:1C AE 22 1C AC 23 1C 18 87
1A59:4C F0 FF 00 78 C6 01 6A
1A61:B1 FB E6 01 58 60 AD 09 03
1A69:1C 0A 0A 0A C8 A2 00 8D
1A71:CA D0 FD 88 D0 F8 60 A9 5C
1A79:00 80 0A 1C 00 0B 1C 20 85
1A81:CF 19 20 D8 19 60 18 65 55
1A89:FD 85 FD A5 FE 69 00 85 5B
1A91:FE 00 E6 FD D0 02 E6 FE 75
1A99:60 18 65 FB 85 FB A5 FC D4
1AA1:69 00 H5 FC 00 E6 FB D0 72
1AA9:02 E6 FC 60 A9 14 A0 00 1D
1AB1:4C 8C 16 8E 22 1C 8C 23 98
1AB9:1C 18 4C FF 20 D8 19 E5
1AC1:A0 3F 20 5E 1A 99 A7 02 88
1AC9:88 10 F7 60 20 F5 19 A2 F8
1AD1:09 A0 40 20 B4 1A 20 49 CC
1AD9:19 43 48 41 4E 47 45 00 C2
1AE1:50 4F 53 49 54 49 4E 4E C5
1AE9:53 00 20 4F 1A 20 49 19 BD
1AF1:20 52 45 54 55 52 4E 20 69
1AF9:54 4F 20 45 58 49 54 00 15
1B01:20 4F 1A 20 49 19 53 50 06
1B09:52 49 54 45 20 4E 4F 20 92
1B11:3E 20 00 A9 00 8D 1E 1C 97
1B19:8D 1F 1C A9 00 00 20 1C CE
1B21:A9 00 8D 58 13 20 56 13 FE
1B29:48 20 4F 1A 20 58 15 20 C3
1B31:49 19 4D 4F 56 45 20 57 50
1B39:49 54 48 20 4A 4F 59 53 C9
1B41:54 48 00 20 4F 1A 20 49 E2
1B49:19 20 20 20 00 52 45 53 C3
1B51:53 20 46 49 52 45 00 20 5E
1B59:4F 1A 00 49 19 20 20 FF
1B61:57 48 45 4E 20 44 4F 4E E1
1B69:45 2E 00 AD 01 1C 8D 3B 77
1B71:1C A9 01 8D 01 1C 68 AA 0D
1B79:F0 06 0E 01 1C CA D0 FA 24
1B81:AD 00 DC 49 FF 29 1F C9 6B
1B89:10 F0 2D 6A 90 05 A9 08 44
1B91:4C A9 1B 6A 90 05 A9 07 55
1B99:4C A9 1B 6A 00 05 A9 06 5C
1BA1:4C A9 1B 6A 90 DA A9 05 BA
1BA9:AE 01 1C A0 01 20 8C 16 BC
1BB1:A0 20 20 6F 1A 4C 81 1B 5B
1BB9:A0 00 AD 01 1C 4A F0 06 F7
1BC1:1C C8 C8 A0 00 FA 0C 1E F5
1BC9:C8 A9 13 AE 01 1C A0 00 7F
1BD1:20 8C 16 8D 21 1C 00 22 8F
1BD9:1C 8C 23 1C AC 1E 1C AD 2B
1BE1:21 1C F0 02 A9 01 99 4F C1
1BE9:1C C8 AD 22 1C 99 4F 1C 3A
1BF1:C8 AD 23 1C 99 4F 1C AD 0E
1BF9:3B 1C 00 01 1C 4C F1 08 94
1C01:00 00 D0 D0 00 00 00 00 60
1C09:05 00 00 00 00 00 00 C3
1C11:00 7F BF DF EF F7 FB DF 74
1C19:FE 3F CF F3 FC 00 00 00 C1
1C21:00 00 00 00 05 1C 9F 9C D6
1C29:1E 1F 9E 81 95 96 97 98 F2
1C31:99 9A 9B 01 01 00 00 83 EB
1C39:00 00 00 46 49 4C 45 4E 2A
1C41:41 4D 45 20 49 4E 20 48 24
1C49:45 52 45 50 2C 57 00 38 5D
1C51:32 00 58 32 00 78 32 00 17
1C59:98 32 00 B8 32 00 D8 32 6F
1C61:00 F8 32 01 18 32 00 38 EF
1C69:32 00 58 32 00 78 32 00 2F
1C71:98 32 00 80 32 00 D8 32 83
1C79:00 F8 32 01 18 32 93 13 0A
1C81:2B 2D DB DD 85 89 86 8A DD
1C89:87 00 00 8C 58 59 4D 53 58
1C91:31 32 33 34 52 4C 55 44 4B

```

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1C99:D2 46 C6 49 4F 51 56 43 E9
1CA1:C4 D3 CC 94 14 C3 5A 57 CF
1CA9:D7 CD D8 D9 DA 24 6C 0B 45
1CB1:EE 09 81 0B 7B 0B 9F 0B D6
1CB9:87 0B E6 0B E9 0B EC 0B 66
1CC1:EF 0B F2 0B F5 0B F8 0B 9C
1CC9:FB 0B 0F 0C 37 0C 43 0C E1
1CD1:69 0C 6F 0C 75 0C 7F 0C 57
1CD9:85 0C 92 0C CA 0C F7 0C 6D
1CE1:16 0D 39 0D 4B 0D 77 0D EA
1CE9:4C 0E 60 0E 15 10 72 10 96
1CF1:70 0E 2C 12 64 14 61 14 D6
1CF9:DC 10 15 11 79 11 CD 1A 1E
1D01:CA 0F B9 0F 55 0C 1B 0C A9
1D09:29 0C 1E 12 A2 15 00 00 29

```

Machine Language Programming

Article on page 56.

File Stripper

```

HF 100 DATA 72,162,2,32,201,25
5,104,32,210,255,32,204
,255,96
SD 110 DATA 162,0,134,252,162,
1,32,198,255,32,228,255
,72
CH 120 DATA 32,204,255,104,166
,144,134,253,166,252
JD 130 DATA 240,21,162,13,201,
32,240,6,162,32,201,13
XJ 140 DATA 240,15,72,138,32,0
,32,104,76,66,32,162,1
KG 150 DATA 201,13,240,5,32,0,
32,162,0,134,252
EM 160 DATA 166,253,240,197,16
9,13,166,252,240,3,32,0
,32,96
AJ 200 FOR J=8192 TO 8278
EJ 210 READ X:T=X
BP 220 POKE J,X
AE 230 NEXT J
XB 240 IF T<>10628 THEN STOP
DH 300 INPUT "NAME OF TEXT FIL
E";NS
JQ 310 OPEN 15,8,15
AA 320 OPEN 1,8,3,NS
QR 330 INPUT#15,E,ES,E1,E2:IF
[SPACE]E<>0 THEN PRINT
[SPACE]ES:GOTO 500
EG 340 INPUT "NAME OF <NEW> FI
XED FILE";FS
DM 350 OPEN 2,8,4,FS+",S,W"
HD 360 INPUT#15,E,ES,E1,E2:IF
[SPACE]E<>0 THEN PRINT
[SPACE]ES:GOTO 500
QJ 370 SYS 8206
XB 380 INPUT#15,E,ES,E1,E2:IF
[SPACE]E<>0 THEN PRINT
[SPACE]ES:GOTO 500
HM 500 CLOSE 2
AM 510 CLOSE 1
EQ 520 CLOSE 15

```

128 Math Graphics

Article on page 67.

Program 1: Math Graphics Demo

```

FS 1000 REM COPYRIGHT 1988 COM
PUTE! PUBLICATIONS, IN
C. - ALL RIGHTS RESERV
ED
JS 1010 PRINT"[CLR]{3 SPACES}C
OPYRIGHT 1988 COMPUTE!
PUB., INC.":PRINTTAB(
11)"ALL RIGHTS RESERVE
D"

```

```

BD 1020 SLEEP3
FB 1030 :
JQ 1040 GOSUB 2890{2 SPACES}:R
EM INITIALIZE
PX 1050 GOSUB 2410{2 SPACES}:R
EM STAR
CX 1060 GOSUB 1380{2 SPACES}:R
EM TWISTED BAND
DQ 1070 GOSUB 2030{2 SPACES}:R
EM SPIRAL CONE
CE 1080 GOSUB 2230{2 SPACES}:R
EM SIDE SPIRAL CONE
BE 1090 GOSUB 1600{2 SPACES}:R
EM SPIKES
GF 1100 GOSUB 1170{2 SPACES}:R
EM RIGHT OVAL
KJ 1110 GOSUB 1860{2 SPACES}:R
EM MULTILOBE
XP 1120 GRAPHIC CLR
EF 1130 END
CJ 1140 :
KK 1150 REM --- RIGHTOVAL ----

JK 1160 :
EJ 1170 GRAPHIC 1,1
HF 1180 R1=150
QJ 1190 R2=25
HH 1200 R3=25
CP 1210 R4=85
BC 1220 INC=1/64
FH 1230 T$="RIGHT OVAL"
      {5 SPACES}:GOSUB 2770
      {5 SPACES}:REM PRINT T
      TITL
BM 1240 COLOR 1,6
PC 1250 FOR THETA=0 TO 2*PI STE
P INC
FP 1260 :{3 SPACES}RR=R1
      {3 SPACES}:TT=THETA
      {3 SPACES}:GOSUB 2670
      {SPACE}:X1=POLARX
BJ 1270 :{3 SPACES}RR=R2
      {3 SPACES}:TT=THETA
      {3 SPACES}:GOSUB 2720
      {SPACE}:Y1=POLARY
RD 1280 :{3 SPACES}RR=R3
      {3 SPACES}:TT=THETA+PI
      {SPACE}:GOSUB 2670 :X2
      =POLARX
AE 1290 :{3 SPACES}RR=R4
      {3 SPACES}:TT=THETA+PI
      {SPACE}:GOSUB 2720 :Y2
      =POLARY
RD 1300 :{3 SPACES}DRAW 1,X1,Y
      1 TO X2,Y2
RG 1310 :{3 SPACES}GET A$:IF A
      $<>" THEN RETURN
GC 1320 NEXT THETA
XJ 1330 GOSUB 2820{2 SPACES}:R
EM GET A KEYPRESS
QF 1340 RETURN
GF 1350 :
RM 1360 REM --- TWISTED BAND ---

AH 1370 :
QG 1380 GRAPHIC 1,1
BD 1390 R1=150
JE 1400 R2=35
RH 1410 R3=65
MK 1420 R4=85
PA 1430 INC=1/64
CE 1440 OS=1/3
HK 1450 T$="TWISTED BAND"
      {3 SPACES}:GOSUB 2770
      {SPACE}:REM PRINT TITL
      E
AP 1460 COLOR 1,7
ME 1470 FOR THETA=0 TO 2*PI STE
P INC
JJ 1480 :{3 SPACES}RR=R1
      {3 SPACES}:TT=THETA
      {3 SPACES}:GOSUB 2670
      {SPACE}:X1=POLARX

ES 1490 :{3 SPACES}RR=R2
      {3 SPACES}:TT=THETA
      {3 SPACES}:GOSUB 2720
      {SPACE}:Y1=POLARY
SF 1500 :{3 SPACES}RR=R3
      {3 SPACES}:TT=THETA
      {3 SPACES}:GOSUB 2670
      {SPACE}:X2=POLARX
JH 1510 :{3 SPACES}RR=R4
      {3 SPACES}:TT=THETA+OS
      GOSUB 2720 :Y2=POLARY
AB 1520 :{3 SPACES}DRAW 1,X1,Y
      1 TO X2,Y2
DJ 1530 :{3 SPACES}GET A$:IF A
      $<>" THEN RETURN
XD 1540 NEXT THETA
FH 1550 GOSUB 2820{2 SPACES}:R
EM GET A KEYPRESS
KD 1560 RETURN
RE 1570 :
DX 1580 REM --- SPIKES -----

HF 1590 :
DC 1600 GRAPHIC 1,1
KS 1610 R1=115
FE 1620 R2=85
PA 1630 R3=40
PE 1640 R4=45
XJ 1650 INC1=1/3
GR 1660 INC2=1/6
CB 1670 T$="SPIKES"{5 SPACES}:
      GOSUB 2770 :REM PRINT
      {SPACE}TITL
ER 1680 K=2
CH 1690 FOR T1=0 TO 2*PI STEP I
NC1
RA 1700 :{3 SPACES}FOR T2=0 TO
      2*PI STEP INC2
GS 1710 :{7 SPACES}RR=R1
      {3 SPACES}:TT=T2
      {2 SPACES}:GOSUB 2670
      {SPACE}:X1=POLARX
EJ 1720 :{7 SPACES}RR=R2
      {3 SPACES}:TT=T1
      {2 SPACES}:GOSUB 2720
      {SPACE}:Y1=POLARY
RC 1730 :{7 SPACES}RR=R3
      {3 SPACES}:TT=T1
      {2 SPACES}:GOSUB 2670
      {SPACE}:X2=POLARX
DC 1740 :{7 SPACES}RR=R4
      {3 SPACES}:TT=T2
      {2 SPACES}:GOSUB 2720
      {SPACE}:Y2=POLARY
KX 1750 :{7 SPACES}K=K+1:IF K=
      17 THEN K=2
RA 1760 :{7 SPACES}COLOR 1,K
EC 1770 :{7 SPACES}DRAW 1,X1,Y
      1 TO X2,Y2
QH 1780 :{7 SPACES}GET A$:IF A
      $<>" THEN RETURN
MB 1790 :{3 SPACES}NEXT T2
FB 1800 NEXT T1
AH 1810 GOSUB 2820{2 SPACES}:R
EM GET A KEYPRESS
MD 1820 RETURN
JE 1830 :
HR 1840 REM --- MULTILOBE ----

GF 1850 :
GH 1860 GRAPHIC 1,1
FQ 1870 R1=100
FF 1880 INC=1/120
PF 1890 LOBES=4
CS 1900 T$="MULTILOBE"
      {2 SPACES}:GOSUB 2770
      {SPACE}:REM PRINT TITL
      E
PG 1910 COLOR 1,8
SJ 1920 FOR THETA=0 TO 2*PI STE
P INC
PQ 1930 :{3 SPACES}R2=R1*SIN(L

OBES*THETA)
MX 1940 :{3 SPACES}RR=R2
      {3 SPACES}:TT=THETA
      {3 SPACES}:GOSUB 2670
      {SPACE}:X1=POLARX
ER 1950 :{3 SPACES}RR=R2
      {3 SPACES}:TT=THETA
      {3 SPACES}:GOSUB 2720
      {SPACE}:Y1=POLARY
HD 1960 :{3 SPACES}DRAW 1,XCEN
      TER,YCENTER TO X1,Y1
RF 1970 :{3 SPACES}GET A$:IF A
      $<>" THEN RETURN
MQ 1980 NEXT THETA
DE 1990 GOSUB 2820{3 SPACES}:R
EM GET A KEYPRESS
PR 2000 RETURN
PS 2010 :
XE 2020 REM --- SPIRAL CONE ---

BX 2030 :
FR 2040 GRAPHIC 1,1
FG 2050 R1=100
QB 2060 R2=85
CM 2070 INC=1/62
RM 2080 INC=1/80
KS 2090 LOBES=3
PF 2100 T$="SPIRAL CONE"
      {4 SPACES}:GOSUB 2770
      {SPACE}:REM PRINT TITL
      E
RB 2110 COLOR 1,5
CQ 2120 FOR THETA=0 TO 2*PI STE
P INC
AX 2130 :{3 SPACES}RR=R1
      {3 SPACES}:TT=THETA*LO
      BES :GOSUB 2670 :X1=PO
      LARX
JG 2140 :{3 SPACES}RR=R2
      {3 SPACES}:TT=THETA
      {7 SPACES}:GOSUB 2720
      {SPACE}:Y1=POLARY
CS 2150 :{3 SPACES}DRAW 1,XCEN
      TER,YCENTER TO X1,Y1
SA 2160 :{3 SPACES}GET A$:IF A
      $<>" THEN RETURN
FP 2170 NEXT THETA
JS 2180 GOSUB 2820{2 SPACES}:R
EM GET A KEYPRESS
XP 2190 RETURN
PM 2200 :
QD 2210 REM --- SIDE SPIRAL CO
      NE -----

BP 2220 :
FK 2230 GRAPHIC 1,1
EE 2240 R1=130
CP 2250 R2=80
KJ 2260 INC=1/160
MP 2270 LOBES=3
DH 2280 T$="SIDE SPIRAL CONE"
      {3 SPACES}:GOSUB 2770
      {SPACE}:REM PRINT TITL
      E
PE 2290 COLOR 1,15
BB 2300 FOR THETA=0 TO 2*PI STE
P INC
HM 2310 :{3 SPACES}RR=R1
      {3 SPACES}:TT=THETA
      {7 SPACES}:GOSUB 2670
      {SPACE}:X1=POLARX
BE 2320 :{3 SPACES}RR=R2
      {3 SPACES}:TT=THETA*LO
      BES :GOSUB 2720 :Y1=PO
      LARY
AF 2330 :{3 SPACES}DRAW 1,XCEN
      TER,YCENTER TO X1,Y1
KF 2340 :{3 SPACES}GET A$:IF A
      $<>" THEN RETURN
MG 2350 NEXT THETA
PK 2360 GOSUB 2820{2 SPACES}:R
EM GET A KEYPRESS
AE 2370 RETURN
CG 2380 :

```



```

SH 2390 REM --- STAR -----
-----
AG 2400 :
EE 2410 GRAPHIC 1,1
HD 2420 R1=115
QG 2430 R2=85
GF 2440 R3=40
GK 2450 R4=45
JK 2460 INC1=1/3
BR 2470 INC2=1/6
DK 2480 TS="STAR"(4 SPACES):GO
SUB 2770 :REM PRINT TI
TLE
CB 2490 K=2
PH 2500 FOR T1=0 TO 2*1 STEP I
NC1
CS 2510 :{3 SPACES}FOR T2=0 TO
2*1 STEP INC2
XF 2520 :{7 SPACES}RR=R1
{3 SPACES}:TT=T2+1:GOS
UB 2670 :X1=POLARX
BP 2530 :{7 SPACES}RR=R2
{3 SPACES}:TT=T2+1:GOS
UB 2720 :Y1=POLARY
QH 2540 :{7 SPACES}RR=R3
{3 SPACES}:TT=T1
{2 SPACES}:GOSUB 2670
{SPACE}:X2=POLARX
SA 2550 :{7 SPACES}RR=R4
{3 SPACES}:TT=T1
{2 SPACES}:GOSUB 2720
{SPACE}:Y2=POLARY
AJ 2560 :{7 SPACES}K=K+1:IF K=
17 THEN K=2
QB 2570 :{7 SPACES}COLOR 1,K
DQ 2580 :{7 SPACES}DRAW 1,X1,Y
1 TO X2,Y2
XE 2590 :{7 SPACES}GET A$:IF A
$<>" THEN RETURN
RA 2600 :{3 SPACES}NEXT T2
ED 2610 NEXT T1
MK 2620 GOSUB 2820{9 SPACES}:R
EM GET A KEYPRESS
RE 2630 RETURN
BG 2640 :
RK 2650 REM --- POLARX -----
-----
PJ 2660 :
SE 2670 POLARX=RR*COS(TT)+XCEN
TER
CJ 2680 RETURN
AM 2690 :
GR 2700 REM --- POLARY -----
-----
GM 2710 :
SQ 2720 POLARY=RR*SIN(TT)+YCEN
TER
HM 2730 RETURN
XR 2740 :
PD 2750 REM --- PRINT TITLE --
-----
BS 2760 :
QP 2770 COLOR 1,13:CHAR 1,0,0,
TS
ES 2780 RETURN
RB 2790 :
EF 2800 REM --- GET A KEYPRESS
-----
XB 2810 :
FC 2820 SLEEP 3
QG 2830 COLOR 1,13:CHAR 1,7,24
,"PRESS ANY KEY TO CON
TINUE"
CA 2840 GETKEY A$
GC 2850 RETURN
QF 2860 :
QF 2870 REM --- INITIALIZE ---
-----
CG 2880 :
HB 2890 XCENTER=151
HJ 2900 YCENTER=93
JS 2910 COLOR 0,1{3 SPACES}:RE

```

```

M BACKGROUND
FR 2920 COLOR 4,1{3 SPACES}:RE
M BORDER
CK 2930 RETURN

```

Program 2: Math Graphics Tool Kit

```

FS 1000 REM COPYRIGHT 1988 COM
PUTE! PUBLICATIONS, IN
C. - ALL RIGHTS RESERV
ED
JS 1010 PRINT{CLR}{3 SPACES}C
OPYRIGHT 1988 COMPUTE!
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11)"ALL RIGHTS RESERVE
D"
BD 1020 SLEEP3
FB 1030 :
GK 1040 GOSUB 1090
FK 1050 GOSUB 1440
GP 1060 GOSUB 1640
GC 1070 END
EF 1080 :
EF 1090 REM --- INITIALIZE ---
-----
GF 1100 :
FH 1110 DIM R(19):XCENTER=151:
YCENTER=93
PG 1120 DIM M$(25),X(25),Y(25)
RX 1130 FOR I=1 TO 25
KR 1140 :{2 SPACES}READ M$(I),
X(I),Y(I)
QD 1150 NEXT I
JK 1160 :
JM 1170 DATA "{RVS}A{OFF} R1 =
",1,1,"{RVS}B{OFF} R2
{SPACE}=",1,20
BJ 1180 DATA "{RVS}C{OFF} R3 =
",2,1,"{RVS}D{OFF} R4
{SPACE}=",2,20
KE 1190 DATA "{RVS}E{OFF} THET
A 1'S START = PI *",4,
1
KR 1200 DATA "{RVS}F{OFF} THET
A 1'S END(3 SPACES)= P
I *",5,1
RJ 1210 DATA "{RVS}G{OFF} THET
A 1'S INC(3 SPACES)= P
I /",6,1
GX 1220 DATA "{RVS}H{OFF} THET
A 2'S START = PI *",7,
1
PC 1230 DATA "{RVS}I{OFF} THET
A 2'S END(3 SPACES)= P
I *",8,1
JR 1240 DATA "{RVS}J{OFF} THET
A 2'S INC(3 SPACES)= P
I /",9,1
PA 1250 DATA "{RVS}K{OFF} X1'S
OFFSET(5 SPACES)= PI
{SPACE}/",10,1
BQ 1260 DATA "{RVS}L{OFF} Y1'S
OFFSET(5 SPACES)= PI
{SPACE}/",11,1
BJ 1270 DATA "{RVS}M{OFF} X2'S
OFFSET(5 SPACES)= PI
{SPACE}/",12,1
SE 1280 DATA "{RVS}N{OFF} Y2'S
OFFSET(5 SPACES)= PI
{SPACE}/",13,1
PQ 1290 DATA "{RVS}O{OFF} X1 U
SES THETA(2 SPACES)",1
4,1
BS 1300 DATA "{RVS}P{OFF} Y1 U
SES THETA(2 SPACES)",1
5,1
GC 1310 DATA "{RVS}Q{OFF} X2 U
SES THETA(2 SPACES)",1
6,1
AG 1320 DATA "{RVS}R{OFF} Y2 U
SES THETA(2 SPACES)",1
7,1

```

```

RD 1330 DATA "{RVS}S{OFF} COLO
R(11 SPACES)=",18,1
MG 1340 DATA "{RVS}T{OFF} LOAD
MATHGRAPHIC",20,1
SH 1350 DATA "{RVS}U{OFF} SAVE
MATHGRAPHIC",20,20
QM 1360 DATA "{RVS}V{OFF} DIRE
CTORY",21,1
GB 1370 DATA "{RVS}W{OFF} VIEW
MATHGRAPHIC",21,20
AF 1380 DATA "{RVS}X{OFF} QUIT
",22,1
EX 1390 DATA "{RVS}Y{OFF} REDR
AW MENU",22,20
SG 1400 RETURN
JK 1410 :
KK 1420 REM --- PRINT MENU ---
-----
CM 1430 :
FJ 1440 GRAPHIC 0,1:COLOR 0,7:
COLOR 4,7:COLOR5,2
BK 1450 PRINT CHR$(14)CHR$(11)
;
AR 1460 PRINT{A}****[ 128 MAT
HGRAPHIC TOOL KIT ]***
**$S"
XD 1470 FOR I=1 TO 22
PK 1480 :{4 SPACES}PRINT"-
{37 SPACES}_"
BJ 1490 NEXT I
BS 1500 :
RB 1510 REM --- PRINT VALUES -
-----
MA 1520 :
PF 1530 FOR I=1 TO 25
FR 1540 :{2 SPACES}SYS DEC("CC
6A"),X(I),Y(I)
BJ 1550 :{2 SPACES}PRINT M$(I)
;:IF I<20 THEN PRINT"
{6 SPACES}{6 LEFT}";
HC 1560 :{2 SPACES}IF I<=19 TH
EN PRINTR(I)
QJ 1570 :{2 SPACES}IF I=3 OR I
=19 THEN PRINT"{Q}****
*****{W}";
SX 1580 NEXT I
HF 1590 :
BF 1600 RETURN
PF 1610 :
ED 1620 REM --- GET INPUT ----
-----
XH 1630 :
DC 1640 GOSUB 1880
MX 1650 INPUT"SELECTION =>";A$
:A$=LEFT$(A$,1)
CG 1660 IF A$<"A" OR A$>"Z" TH
EN GOTO 1640
EF 1670 IF A$<"S" THEN GOSUB
{SPACE}1770:GOTO 1640
SK 1680 IF A$="T" THEN GOSUB 2
480:GOSUB 1530:GOTO 16
40
SM 1690 IF A$="U" THEN GOSUB 2
370:GOTO 1640
RK 1700 IF A$="V" THEN GOSUB 2
290:GOSUB 1440:GOTO 16
40
JF 1710 IF A$="W" THEN GOSUB 1
950:GOSUB 1440:GOTO 16
40
BX 1720 IF A$="X" THEN GRAPHIC
CLR:PRINT{CLR}"CHR$(
12);:RETURN
PM 1730 IF A$="Y" THEN GOSUB 1
440:GOTO 1640
AS 1740 :
SR 1750 REM --- NEW VALUE ----
-----
KA 1760 :
AR 1770 GOSUB 1880
CA 1780 INPUT"NEW VALUE =>";N$

```

```

      :N=VAL(LEFT$(N$,5))
GF 1790 A=ASC(A$)-64
AR 1800 R(A)=N
BC 1810 SYS DEC("CC6A"),,X(A),
      Y(A)
KQ 1820 PRINT M$(A);:IF A<20 T
      HEN PRINT" {6 SPACES}
      {6 LEFT}";
HG 1830 PRINTR(A);
AF 1840 RETURN
GF 1850 :
GP 1860 REM --- DRAW INPUT BOX
      -----
QH 1870 :
PE 1880 SYS DEC("CC6A"),,23,0:
      PRINTCHR$(27)+"0";
QE 1890 PRINT" {Z$}****{
      {26 SPACES}}*****{X$}";
MQ 1900 SYS DEC("CC6A"),,23,7
BK 1910 RETURN
BK 1920 :
QM 1930 REM --- DRAW GRAPH ---
      -----
XP 1940 :
BX 1950 COLOR 0,1:COLOR 4,1:GR
      APHC 1,1
AA 1960 IF R(19)=0 THEN K=1 :E
      LSE K=R(19)
JE 1970 COLOR 1,2:CHAR 1,0,0,F
      $
CG 1980 FOR T1=[*R(5) TO [*R(6
      ) STEP 1/R(7)
GA 1990 :{3 SPACES}FOR T2=[*R(
      B) TO [*R(9) STEP 1/R(
      10)
EB 2000 :{7 SPACES}FOR N=1 TO
      {SPACE}4
BP 2010 :{11 SPACES}RR=R(N)
EC 2020 :{11 SPACES}IF R(14+N)
      =1 THEN TT=T1+[1/R(10+N
      ):ELSE TT=T2+[1/R(10+N)
QQ 2030 :{11 SPACES}ON N GOSUB
      2170,2230,2170,2230
JG 2040 :{7 SPACES}NEXT N
FQ 2050 :{7 SPACES}IF R(19)=0
      {SPACE}THEN K=K+1:IF K
      >16 THEN K=2
RC 2060 :{7 SPACES}COLOR 1,K
GA 2070 :{7 SPACES}DRAW ,X1,Y1
      TO X2,Y2
MM 2080 :{7 SPACES}GET A$:IF A
      $<" " THEN GRAPHIC 0,1
      :RETURN
JD 2090 :{3 SPACES}NEXT T2
FD 2100 NEXT T1
XK 2110 COLOR 1,2:CHAR 1,7,24,
      "PRESS ANY KEY TO CONT
      INUE"
FC 2120 GETKEY A$
BE 2130 RETURN
FG 2140 :
KK 2150 REM --- POLARX -----
      -----
DJ 2160 :
SE 2170 POLARX=RR*COS(TT)+XCEN
      TER
XR 2180 IF N=1 THEN X1=POLARX:
      ELSE X2=POLARX
XP 2190 RETURN
PM 2200 :
PR 2210 REM --- POLARY -----
      -----
BP 2220 :
RR 2230 POLARY=RR*SIN(TT)+YCEN
      TER
AH 2240 IF N=2 THEN Y1=POLARY:
      ELSE Y2=POLARY
BQ 2250 RETURN
FS 2260 :
RR 2270 REM --- DIRECTORY -----
      -----
EA 2280 :
QC 2290 PRINT" {CLR}";

```

```

MK 2300 DIRECTORY
PP 2310 PRINT:PRINT"<<PRESS AN
      Y KEY TO CONTINUE>>";
RA 2320 GETKEY B$
QD 2330 RETURN
GD 2340 :
HS 2350 REM --- SAVE MG -----
      -----
JF 2360 :
BQ 2370 GOSUB 2590:IF F$="" TH
      EN RETURN
JK 2380 DOPEN#2,(F$),W
XB 2390 IF DS THEN :SYS DEC("C
      C6A"),,23,7:PRINT DSS;
      :SLEEP 3:GOTO 2430
GC 2400 FOR I=1 TO 19
MD 2410 :{3 SPACES}PRINT#2,R(I
      )
HD 2420 NEXT I
FE 2430 DCLOSE#2
BJ 2440 RETURN
BM 2450 :
ED 2460 REM --- LOAD MG -----
      -----
PQ 2470 :
CD 2480 GOSUB 2590:IF F$="" MM
      EN RETURN
BS 2490 DOPEN#2,(F$),R
EG 2500 IF DS THEN :SYS DEC("C
      C6A"),,23,7:PRINT DSS;
      :SLEEP 3:GOTO 2540
BF 2510 FOR I=1 TO 19
FP 2520 INPUT#2,R(I)
CJ 2530 NEXT I
AR 2540 DCLOSE#2
BB 2550 RETURN
RC 2560 :
MK 2570 REM --- GET FILENAME -
      -----
HD 2580 :
CK 2590 GOSUB 1880:PRINTCHR$(2
      7)+"Q";
KP 2600 INPUT"FILENAME =>";F$:
      F$=LEFT$(F$,16)
HC 2610 RETURN

```

1541 Speed And Alignment Tester

See instructions in article on page 63 before typing in.

```

0801:0D 08 0A 00 9E 28 32 30 05
0809:36 33 29 00 00 00 4C C1 80
0811:0A 4C 1E 04 4C CF 04 4C 33
0819:D8 04 4C 9F 04 4C A3 04 B6
0821:4C 3D 06 4C 00 06 4C 90 6D
0829:04 4C B3 04 4C CA 04 20 BA
0831:FA 04 D0 0A A5 18 C9 2E C9
0839:90 02 A9 2C F0 07 85 22 86
0841:A5 22 C9 01 F6 07 28 BA 94
0849:05 C6 22 D0 F3 A9 01 85 AC
0851:18 20 3F 05 A2 00 20 C1 C4
0859:05 A0 00 20 D2 05 A9 EE 03
0861:8D 0C 1C 20 F5 05 A0 00 C5
0869:84 4D 20 5E 05 F0 04 A2 8F
0871:00 D0 18 A5 18 8D F1 06 F3
0879:A4 22 CC F1 06 D0 03 EE 85
0881:F2 06 C8 CC F1 06 D0 03 MM
0889:EE F3 06 A4 4D 8A 99 E0 C1
0891:06 E6 4D A5 4D C9 11 D0 E6
0899:D1 AD 00 1C 29 F7 4C B8 3A
08A1:04 20 FA 04 D0 MM A5 18 A7
08A9:C9 2E 90 92 A9 2D D0 8E 97
08B1:78 20 BD 05 78 A5 22 C9 76
08B9:12 F0 09 90 15 C6 22 20 61
08C1:BA 05 F0 F1 AD 00 1C 29 7C
08C9:F3 8D 00 1C A9 EC 8D MM C1
08D1:1C 60 E6 22 20 B0 05 F0 25
08D9:DC D0 E9 20 F2 04 D0 D4 E9
08E1:20 E8 04 20 B3 05 4C 48 51

```

```

08E9:04 20 E8 04 20 B3 05 E6 22
08F1:22 A5 22 20 43 05 4C 48 D1
08F9:04 78 AD 00 1C 09 MM 8D 82
0901:00 1C 60 78 AD 00 1C 09 5C
0909:0C D0 F4 20 F2 04 A9 EE DF
0911:8D 0C 1C A0 00 20 D2 05 A5
0919:20 27 05 F0 1A A9 MM 85 C1
0921:4A 20 BA 05 C6 4A D0 F9 03
0929:20 27 05 F0 0A 20 B3 05 02
0931:20 27 05 F0 02 A9 2D MM 3E
0939:A2 03 20 48 05 8A 48 20 E8
0941:5A MM F0 08 68 AA CA 10 F3
0949:F1 A9 20 60 68 A9 00 60 13
0951:A5 18 85 22 20 4B F2 85 A8
0959:43 AD 00 1C 29 9F 1D 56 92
0961:05 MM MM 1C A9 00 60 00 29
0969:20 40 60 A9 FF D0 02 A9 33
0971:00 85 4B A2 64 MM DB M5 D8
0979:D0 33 50 FE B0 AD 01 1C 55
0981:C9 52 D0 2A MM 24 MM C8 EF
0989:50 FE B0 AD 01 1C 99 24 45
0991:00 C8 C0 08 MM F2 8A 48 1E
0999:20 97 F4 68 AA A9 00 45 MM
09A1:16 45 17 45 18 45 19 C5 15
09A9:1A F0 09 A9 27 60 CA D0 E1
09B1:C4 A9 MM 60 A5 4B D0 06 9C
09B9:A5 40 C5 19 D0 F0 A9 00 D9
09C1:60 20 B3 05 AE 00 1C 88 69
09C9:4C C1 05 MM BD 05 AE 00 74
09D1:1C CA 8A 29 03 MM 44 AD EC
09D9:00 1C 29 FC 05 44 MM 00 3C
09E1:1C A0 MM A2 MM CA MM FD DF
09E9:88 D0 FA 60 A9 D0 8D 05 8A
09F1:18 2C 05 18 10 0D 2C 00 4A
09F9:1C 30 F6 AD 01 1C B0 A0 6A
0A01:00 98 60 A9 21 60 A9 00 BF
0A09:A0 13 99 E0 06 88 10 FA E0
0A11:60 20 F2 04 29 10 D0 05 2C
0A19:A9 26 4C 91 06 A9 EE 8D 70
0A21:0C 1C A9 MM 8D E5 06 A0 58
0A29:00 20 D2 05 CE E5 06 D0 DA
0A31:F6 20 F5 05 20 27 05 D0 50
0A39:00 A5 18 C9 24 90 02 85 47
0A41:22 A5 22 C9 24 B0 07 E6 89
0A49:22 20 MM 05 F0 F3 20 E8 5D
0A51:04 A9 CE 8D 0C 1C A9 FF A8
0A59:8D 01 1C 8D 03 1C A9 55 02
0A61:A2 28 A0 MM 8C E4 06 50 39
0A69:FE B8 MM 01 1C 88 D0 F7 89
0A71:CA D0 F4 A2 05 A9 FF 50 07
0A79:FE B8 8D 01 1C CA D0 F7 A2
0A81:50 FE B8 20 00 FE 20 A0 73
0A89:06 D0 17 MM 97 MM D0 12 42
0A91:8E E0 06 8C E1 06 MM 97 AD
0A99:06 D0 07 8E E2 06 8C E3 DA
0AA1:06 MM 8D E4 06 4C B3 04 9D
0AA9:A9 MM AA A8 2C MM 1C 10 1C
0AB1:FB 2C 00 1C 10 08 E8 D0 D3
0AB9:F8 C8 D0 F5 A9 21 B8 60 99
0AC1:20 44 E5 AD 21 D0 0D F5 EB
0AC9:13 AD 20 D0 8D F6 13 A9 FB
0AD1:90 8D 21 D0 8D 20 D0 A2 F3
0AD9:16 A0 00 20 8C 0F A9 16 2D
0AE1:85 02 A9 12 85 FB A9 00 FE
0AE9:85 FD A9 MM 85 FC A9 04 6D
0AF1:05 FE 20 D9 MM 20 3A E0 9D
0AF9:B1 FB 20 A8 FF C8 A0 20 39
0B01:90 F6 20 4C 0E 20 AE FF 34
0B09:C6 02 D0 E6 20 44 E5 A2 0C
0B11:16 A0 00 20 8C 0F A0 14 52
0B19:20 C6 13 A0 F3 20 C2 13 16
0B21:20 E4 FF C9 00 F0 F9 C9 9E
0B29:31 F0 4C C9 32 D0 03 4C 61
0B31:B0 0C C9 51 D0 EA 20 80 E3
0B39:0F A9 49 20 A8 FF A9 30 35
0B41:20 A8 FF A9 3A MM A8 FF CF
0B49:20 AE FF 20 80 0F A9 55 06
0B51:20 A8 FF A9 3A 20 A8 FF DF
0B59:A9 00 85 A2 A5 20 C9 40 AA
0B61:30 FA 20 AE FF A2 44 E5 2C
0B69:AD F5 13 8D 21 D0 AD F6 AD
0B71:13 8D 20 MM 4C E7 FF 20 A7
0B79:44 E5 A2 0B A0 1B MM 8C 6E
0B81:0F A0 F4 20 AA 13 A0 5B 26
0B89:20 CA 13 20 E4 FF C9 00 81

```


0B91:F0 F9 C9 05 D0 03 4C 00 60	0E39:60 A5 FD 20 A8 FF A5 FE 40	10E1:45 54 55 52 4E 20 54 4F 74
0B99:0B 20 44 E5 A2 00 A0 1B C1	0E41:20 A8 FF A9 20 20 A8 FF 05	10E9:20 4D 41 49 4E 20 4D 45 FC
0BA1:20 0C 0F A2 06 20 95 13 E5	0E49:A0 00 00 18 A5 FB 69 20 53	10F1:4E 55 00 0D 0D 0D 0D 9E B4
0BA9:A0 43 20 C2 13 A9 12 20 94	0E51:85 FB 90 02 E6 FC 18 A5 62	10F9:11 20 20 20 20 20 20 92
0BB1:06 0F 20 E0 0E A9 E0 20 1A	0E59:FD 69 20 85 FD 90 02 E6 48	1101:20 20 20 20 49 4E 53 45 B0
0BB9:A0 FF A9 06 20 A8 FF A9 07	0E61:FE 60 A0 00 A2 00 38 A5 54	1109:52 54 20 42 4C 41 4E 00 E0
0BC1:05 20 A8 FF 20 CA 0E A0 60	0E69:0D E9 3C 85 8F A5 8C E9 BC	1111:20 44 49 53 4B 0D 0D 68
0BC9:05 00 A5 FF 99 8A 00 00 9E	0E71:00 85 8E 90 29 A5 8F 85 4E	1119:0D 0D 9E 20 20 20 20 20 BC
0BD1:D0 F7 20 AB FF A5 00 F0 AB	0E79:8D A5 8E 85 8C C0 00 E6 FF	1121:20 20 20 50 52 45 53 53 06
0BD9:03 4C 90 0C D8 30 A5 8F DA	0E81:88 84 B1 86 B2 84 8E 86 EC	1129:00 1E 12 41 4E 59 20 4B 9C
0BE1:E9 DB 85 8D A5 8E E9 46 EE	0E89:8F C0 02 90 09 C0 04 90 CA	1131:45 59 92 9E 20 57 48 45 BC
0BE9:85 8C B0 24 A9 2B 85 B3 F6	0E91:09 A9 1C 85 B4 60 A9 99 8C	1139:4E 00 52 45 41 44 59 0D 04
0BF1:38 A9 DB E5 8F 20 8D A9 BF	0E99:00 F9 A9 9E D0 F5 38 A5 30	1141:9A 00 0D 9A 4E 4F 52 4D 9D
0BF9:46 E5 8E 85 8C 20 63 0E 90	0EA1:8D E9 06 85 8F A5 8C E9 2E	1149:41 4C 20 44 49 53 4B 00 B5
0C01:10 A5 B1 69 2C 85 B1 A9 DF	0EA9:00 85 8E 90 D4 A5 8F 85 E3	1151:44 52 49 56 45 20 53 50 5A
0C09:01 69 00 85 B0 4C 38 0C 87	0EB1:8D A5 8E 85 8C E0 D0 E6 B8	1159:45 45 44 20 49 53 3A 20 26
0C11:A9 20 85 B3 20 63 0E A5 85	0EB9:A5 BA 20 B1 FF A5 B9 29 A9	1161:00 12 33 30 30 2E 30 92 6B
0C19:B2 C9 00 F0 0D E6 B1 D0 44	0EC1:EF 09 E0 20 93 FF 4C AE 1A	1169:20 50 4D 0D 0D 0D 9A 60
0C21:02 E6 B0 38 A9 0A E5 B2 81	0EC9:FF 20 AE FF A5 BA 20 B4 D0	1171:41 43 54 55 41 4C 20 44 A4
0C29:85 B2 30 A9 2C 05 B1 85 34	0ED1:FF A9 6F 85 B9 4C 96 FF CA	1179:49 53 4B 00 44 52 49 56 04
0C31:B1 A9 01 E9 00 85 B0 A5 60	0ED9:20 00 0F A0 02 B9 00 13 2D	1181:45 20 53 50 45 45 44 00 A5
0C39:B4 20 D2 FF A2 0D 20 A4 42	0EE1:20 A8 FF 88 10 F7 60 20 02	1189:49 53 3A 20 99 12 20 20 E3
0C41:0C A9 12 20 D2 FF A5 B0 A0	0EE9:00 FF A0 02 B9 85 13 20 8C	1191:20 20 20 92 20 52 50 4D 31
0C49:A6 B1 20 CD BD A9 2E 00 13	0EF1:A8 FF 88 10 F7 60 20 80 76	1199:0D 0D 0D 9A 54 48 45 20 3F
0C51:D2 FF A9 00 A6 B2 20 CD 16	0EF9:0E A0 02 B9 8B 13 20 A8 33	12A1:44 49 46 46 45 52 45 4E B1
0C59:8D A2 10 20 AA 0C A5 B3 81	0F01:FF 88 10 F7 60 48 20 F7 1F	12A9:43 45 20 49 4E 20 53 50 41
0C61:20 D2 FF A6 8E E0 0A 00 65	0F09:0E 68 20 A8 FF A9 04 20 A5	12B1:45 45 44 20 49 53 3A 20 7E
0C69:05 A9 20 20 D2 FF A9 00 5E	0F11:A8 FF 4C AE FF 20 06 0F 93	12B9:99 12 20 20 20 20 20 92 87
0C71:20 CD 00 A9 2E 20 D2 FF F6	0F19:20 E8 0E A9 E0 20 A8 FF B6	12C1:20 52 50 4D 0D 0D 0D 2B
0C79:A9 00 A6 8F 20 CD BD 00 00	0F21:A9 06 20 A8 FF A9 14 20 13	12C9:0D 00 0D 9E 20 20 20 20 23
0C81:E4 FF F0 0B A9 0C 20 06 9E	0F29:A8 FF 20 CA 0E A0 00 20 5E	12D1:20 20 20 20 50 52 45 53 BB
0C89:0F 20 E7 FF 4C 0D 0B A9 84	0F31:A5 FF 99 E0 13 C8 C0 14 B4	12D9:53 20 1E 12 41 4E 59 20 A8
0C91:0F 20 06 FF 4C B3 00 A2 D4	0F39:D0 F5 20 A8 FF A0 00 84 03	12E1:4B 45 59 92 9E 20 57 48 BB
0C99:0D 20 AA 0C A0 52 00 AA 8F	0F41:8D 84 8E 84 8C A9 10 85 12	12E9:45 4E 20 44 4F 4E 45 0D D5
0CA1:13 20 E4 FF F0 FB 4C 85 7D	0F49:8B C8 C0 11 F0 0E A5 8D 21	12F1:9A 00 0D 0D 9A 20 20 20 89
0CA9:0C 00 1C 18 4C F0 FF 20 3B	0F51:18 79 E0 13 85 8D 90 F1 9C	12F9:20 20 20 20 20 20 20 1C
0CB1:44 E5 A9 00 8D 21 D0 8D C3	0F59:E6 8E D0 ED 20 D5 0F 20 1E	1201:20 50 52 45 53 53 20 9E AE
0CB9:20 00 A2 0F A0 2B 10 8C 09	0F61:E4 FF C9 00 60 E0 A0 90 56	1209:51 9A 20 54 4F 20 51 55 B0
0CC1:0F A0 87 20 C6 13 A0 5B 9B	0F69:09 E0 64 90 A0 A9 00 4C 1D	1211:49 54 00 0D 0D 0D 0D 9E 15
0CC9:20 AA 13 20 E4 FF C9 00 BB	0F71:CD BD A9 20 20 D2 FF A9 13	1219:20 20 20 20 20 20 31 29 68
0CD1:F0 F9 C9 05 D0 00 4C 0D AA	0F79:20 20 D2 FF 4C 6E 0F A5 E9	1221:20 9A 44 49 53 4B 20 52 73
0CD9:0B C9 31 D0 0C 20 F7 0D FA	0F81:BA 20 B1 FF A9 6F 85 B9 0B	1229:4F 54 41 54 49 4F 4E 20 BB
0CE1:A9 01 85 8F A9 15 4C FD F0	0F89:4C 93 FF 86 BE 84 C3 38 E2	1231:53 50 45 45 44 20 54 45 A0
0CE9:0C C9 41 D0 06 A9 02 85 10	0F91:A9 28 E5 BE 4A 85 BF A9 C8	1239:53 54 9E 0D 00 20 20 20 0A
0CF1:8F D0 0A A9 00 85 8F 20 76	0F99:0D 20 D2 FF A6 BF 00 A1 B6	1241:20 20 20 32 29 20 9A 48 E0
0CF9:F7 D0 A9 00 20 16 0F F0 EE	0FA1:13 A9 1F 20 D2 FF A4 BE 38	1249:45 41 44 20 41 4C 49 47 FF
0D01:03 4C 8E 0D A9 99 20 D2 1F	0FA9:A9 AF 20 D2 FF 88 00 F8 76	1251:4E 4D 45 4E 54 20 54 45 8E
0D09:FF A6 02 20 66 0F A2 01 C4	0FB1:A9 0D 20 D2 FF A6 00 00 53	1259:53 54 0D 0D 0D 0D 0D 72
0D11:20 A1 13 A0 F1 13 C5 02 4A	0FB9:A1 13 A4 C3 20 A4 13 A6 B6	1261:9A 20 20 20 20 20 20 2C
0D19:F0 00 A9 96 20 D2 FF AE 86	0FC1:BF 20 A1 13 A9 1F 20 D2 0A	1269:20 50 52 45 53 53 20 9E 17
0D21:F1 13 20 66 0F A2 02 20 8A	0FC9:FF A4 BE A9 B7 20 D2 FF 67	1271:31 20 9A 4F 52 20 9E 32 01
0D29:A1 13 A6 8D E0 64 D0 04 C4	0FD1:88 D0 F0 60 A9 00 85 B0 96	1279:20 9A 54 4F 20 43 4F 4E CE
0D31:A9 99 D0 8A 8E 5E B0 04 27	0FD9:85 B1 A2 10 06 8D 26 8E BD	1281:54 49 4E 55 45 00 0D 0D 92
0D39:A9 96 D0 02 A9 9E 20 D2 E2	0FE1:26 B0 26 B1 A5 B0 38 E5 65	1289:0D 0D 9E 11 20 20 00 20 3E
0D41:FF A6 8D 20 66 0F A5 8F 03	0FE9:8B A0 A5 B1 E5 8C 00 00 00	1291:20 20 20 20 20 20 49 4E 53 E9
0D49:C9 01 F0 42 A2 00 20 A1 C5	0FF1:E6 8D 85 B1 84 B0 CA 00 FF	1299:45 52 54 20 46 4F 52 4D E2
0D51:13 A9 03 00 16 0F F0 00 93	0FF9:E3 60 7A 00 8D 5A 00 00 76	12A1:41 54 54 45 44 20 44 49 CE
0D59:4C 00 A0 A6 8D D0 04 A9 B5	1001:12 31 35 34 31 20 44 49 3C	12A9:53 4B 0D 0D 20 20 96 73 0E
0D61:99 D0 0A E0 51 00 04 A9 4A	1009:53 4B 20 44 52 49 56 45 97	12B1:20 9A 3D 20 54 52 41 43 E7
0D69:96 D0 02 A9 9E 20 D2 FF F8	1011:20 54 45 53 54 45 52 92 23	12B9:4B 20 42 45 49 4E 47 20 5A
0D71:A6 8D 20 66 0F AD F3 13 D6	1019:0D 00 9E 12 53 50 45 45 60	12C1:54 45 53 54 45 44 00 20 86
0D79:0D F2 13 F0 11 AD F2 13 80	1021:44 20 43 48 45 43 4B 92 B8	12C9:20 9E 7A 20 9A 3D 00 54 55
0D81:CD F3 13 B0 04 A9 2B 00 DA	1029:0D 00 9E 12 41 4C 49 47 D9	12D1:52 41 43 4B 20 41 43 54 6D
0D89:02 A9 2D 20 D2 FF E6 02 1D	1031:4E 4D 45 4E 54 20 43 48 4B	12D9:55 41 4C 4C 59 20 52 45 7C
0D91:A5 8F C9 01 F0 3D A5 02 75	1039:45 43 4B 92 0D 00 9A 12 0F	12E1:41 44 0D 20 20 81 61 20 45
0D99:C9 24 F0 29 C9 13 D0 0A 98	1041:20 50 52 45 53 53 20 41 8D	12E9:9A 3D 20 4F 4E 20 54 52 91
0DA1:A9 14 85 BE A9 07 85 BF 66	1049:4E 59 20 4B 45 59 20 92 02	12F1:41 43 4B 20 52 45 41 44 61
0DA9:D0 02 E6 BF A4 BE A6 BF B2	1051:00 96 12 45 52 52 4E 00 7A	12F9:41 42 49 4C 49 54 59 20 AB
0DB1:18 20 F0 FF A9 00 4C FD F9	1059:92 00 0D 0D 0D 9A 50 52 FA	1301:28 25 29 0D 20 20 99 78 A7
0DB9:0C A9 09 D0 02 A9 0C 20 61	1061:45 53 53 20 9E 12 53 50 99	1309:20 9A 3D 20 42 45 54 57 B6
0DC1:E1 00 4C B0 0C A5 8F C9 84	1069:41 43 45 92 9A 20 54 4F 1A	1311:45 45 4E 20 54 52 41 43 A8
0DC9:02 00 EE A9 09 20 06 0F 75	1071:20 43 48 45 43 4B 20 41 98	1319:4B 20 52 45 41 44 41 42 6B
0DD1:4C F8 00 A9 18 20 E1 0D 7E	1079:4C 49 47 4E 4D 45 4E 54 50	1321:49 4C 49 54 59 20 28 25 2E
0DD9:A9 1B 20 06 0F 4C B0 0C 0B	1081:0D 0D 50 52 45 53 53 20 D8	1329:29 0D 0D 20 20 20 96 73 EC
0DE1:20 06 0F A2 18 A0 15 18 1F	1089:9E 12 41 92 9A 20 46 4F FF	1331:20 20 20 20 9E 7A 20 20 12
0DE9:20 F0 FF A0 3F 20 AA 13 3D	1091:52 20 41 55 54 4F 20 52 D2	1339:81 61 20 20 20 20 99 78 AB
0DF1:20 E4 FF D0 F0 60 20 44 4A	1099:45 50 45 41 54 20 41 4C 1F	1341:20 20 20 20 20 96 73 20 E7
0DF9:E5 A0 AD F0 C6 13 A2 13 C1	10A1:49 47 4E 4D 45 4E 54 20 03	1349:20 20 9E 7A 20 20 20 81 46
0E01:A9 63 20 A3 13 A9 B2 20 CD	10A9:43 48 45 43 4B 0D 00 50 53	1351:61 20 20 20 20 99 78 9A 29
0E09:D2 FF A2 13 A9 63 20 A3 02	10B1:52 45 53 53 20 9E 12 31 BC	1359:0D 0D 0D 0D 9A 20 20 20 0E
0E11:13 A9 12 85 02 A9 0D 20 AC	10B9:92 9A 20 54 4F 20 53 54 09	1361:20 20 50 52 45 53 53 20 2D
0E19:D2 FF A2 13 20 9D 13 A9 6B	10C1:4F 50 20 41 54 20 54 52 D3	1369:12 9E 46 31 92 9A 20 54 AF
0E21:62 20 D2 FF C6 02 00 ED 9E	10C9:41 43 4B 20 31 0D 00 50 EE	1371:4F 20 52 45 54 55 52 4E D0
0E29:A2 07 A0 01 86 BF 84 8E 77	10D1:52 45 53 53 20 9E 12 46 F1	1379:20 54 4F 20 4D 41 49 4E 01
0E31:18 20 F0 FF A9 01 85 02 DD	10D9:31 92 9A 20 54 4F 20 52 FE	1381:20 4D 45 4E 55 0D 00 57 CE

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1389:2D 4D 45 2D 4D 52 2D 4D 70
1391:A9 91 D0 0E A9 11 D0 0A 29
1399:A9 9D D0 06 A9 1D D0 02 DB
13A1:A9 20 20 D2 FF CA D0 FA 9D
13A9:60 A9 10 85 FC 84 PB A0 57
13B1:00 B1 FB F0 0B 20 D2 FF 51
13B9:E6 FB D0 F5 E6 FC D0 F1 8A
13C1:60 A9 11 D0 E5 A9 12 D0 84
13C9:E2 A9 13 D0 DE 00 00 00 12

```

BASIC For Beginners

Article on page 52.

Math Drill

```

BE 10 POKE53280,1:POKE53281,6:
POKE646,1
SM 15 REM FOR C16 AND C+4 USE
[SPACE]-COLOR4,2,7:COLOR
0,7,4:COLOR1,2,7 INSTEAD
OF POKES
FX 20 PRINT"[CLR]"
KP 30 INPUT"WHAT'S YOUR FIRST
NAME";NS
EA 40 IFNS=""THEN20
EK 50 L=19-((LEN(NS)+15)/2)
GD 60 PRINT"[CLR]"
SS 70 FORT=1TO4:PRINT:NEXT
AH 80 PRINTTAB(L)"[RVS]"NS"S
[SPACE]MATH PRACTICE
[OFF]"
AP 90 PRINT
SA 100 PRINTTAB(13)"1. ADD
DF 110 PRINTTAB(13)"2. SUBTRAC
T
GM 120 PRINTTAB(13)"3. MULTIPL
Y
EC 130 PRINTTAB(13)"4. DIVIDE
GP 140 PRINT:PRINTTAB(12)"WHIC
H NUMBER?
HR 150 GETAS:IFAS<>"1"THENIFAS
<>"2"THENIFAS<>"3"THENI
FAS<>"4"THEN150
JC 160 N=10:Q=RND(-TI/101):REM
SEE ARTICLE
SS 170 X=VAL(AS)
DS 180 P=P+1
RS 190 ONXGOSUB280,280,220,220
QE 200 ONXGOSUB350,360,370,410
QD 210 GOSUB420:GOTO180
DE 220 IFFLAG=1THEN280
HX 230 PRINT:PRINTTAB(13)"TABL
E";
QX 240 INPUT$
JS 250 T=VAL(T$)
SK 260 IFT>NTHENPRINT"[3 UP]":
GOTO230
BM 270 IFT<1THENPRINT"[3 UP]":
GOTO230
KS 280 A=INT(N*RND(1))+1
KK 290 B=INT(N*RND(1))+1
MG 300 IF(X=2)AND(A<=B)THEN280
DC 310 PRINT"[CLR]":POKE53281,
6:REM FOR C16 AND C+4 -
USE COLOR0,7,4 INSTEAD
[SPACE]OF POKE
XK 320 FORJ=1TO7:PRINT:NEXT
DS 330 PRINT:PRINTTAB(6)"PRESS
ONLY RETURN FOR ANSWER
AR 340 PRINT:PRINTTAB(13);:RET
URN
JX 350 PRINTA+"B"="";:C=A+B:RE
TURN
MM 360 PRINTA-"B"="";:C=A-B:RE
TURN
MB 370 L=INT(2*RND(1))+1
KP 380 ONLGOTO390,400
XM 390 PRINTT"X"A="";:C=A*T:RE
TURN

```

```

FG 400 PRINTA"X"T="";:C=A*T:RE
TURN
XA 410 PRINTA*T"/"T"="";:C=A:RE
TURN
QD 420 D$="":INPUTD$
SR 430 D=VAL(D$)
FP 440 IFC=DTHEN480
BX 450 POKE53281,2:REM FOR C16
AND C+4 - USE COLOR0,3
,5 INSTEAD OF POKE
JQ 460 PRINT:PRINTTAB(12)"THE
[SPACE]ANSWER IS"C
SB 470 GOTO510
AS 480 POKE53281,5:REM FOR C16
AND C+4 USE COLOR0,6,4
INSTEAD OF POKE
SA 490 PRINT:PRINTTAB(16)"GOOD
!"
ES 500 K=K+1
KJ 510 PRINT:PRINT" PRESS RETU
RN TO CONTINUE OR Q TO
[SPACE]QUIT.
KX 520 GETB$:IF(B$<>CHR$(13))A
ND(B$<>"Q")THEN520
RC 530 IFB$=CHR$(13)THENFLAG=1
:RETURN
MB 540 PRINT"[CLR]":POKE53281,
6:REM FOR C16 AND C+4 -
USE COLOR0,7,4 INSTEAD
OF POKE
CJ 550 PRINT:PRINT" SCORE:"K"C
ORRECT OUT OF"P"PROBLEM
S

```

64 Keyboard Enhancer

See instructions in article on page 72 before typing in.

Program 1: Keyboard Enhancer

```

C000:A9 00 8D E9 C0 8D EA C0 79
C008:8D EB C0 78 A9 3F 8D 8F DF
C010:02 A9 C0 8D 90 02 58 A9 D4
C018:A0 85 FC A9 DE 85 FE A9 3A
C020:00 85 FB 85 FD A0 00 B1 FE
C028:FB 91 FB B1 FD 91 FD 88 61
C030:D0 F5 E6 FC E6 FE D0 ED 07
C038:A5 01 29 FD 85 01 60 48 0B
C040:98 48 8A 48 A5 CB C9 40 26
C048:D0 05 A9 00 8D EA C0 AD EF
C050:EA C0 C9 01 D0 0E A5 CB 96
C058:CD EC C0 D0 07 A9 40 85 06
C060:CB 4C E1 C0 A9 41 8D EC 7D
C068:C0 AD 8D 02 29 04 C9 04 78
C070:D0 08 A9 01 8D E9 C0 4C 83
C078:E1 C0 AD E9 C0 C9 01 F0 8F
C080:03 4C E1 C0 A5 CB C9 40 0F
C088:D0 03 4C E1 C0 A2 00 A0 0C
C090:00 8C EB C0 A5 CB DD ED C4
C098:C0 D0 19 8D EC C0 A9 01 69
C0A0:8D EB C0 E8 BD ED C0 8D 3F
C0A8:D1 C0 E8 BD ED C0 8D D2 9C
C0B0:C0 4C C1 C0 C8 E8 E8 E8 8E
C0B8:C0 15 D0 D8 A9 00 00 EB DB
C0C0:C0 AD EB C0 C9 01 F0 00 D3
C0C8:A9 00 8D E9 C0 4C E1 C0 2B
C0D0:20 00 00 A9 00 8D E9 C0 C7
C0D8:A9 01 8D EA C0 A9 40 85 82
C0E0:CB 68 AA 68 A8 68 4C 48 06
C0E8:EB 00 00 00 00 2E B1 C3 40
C0F0:12 7B C3 22 FF C2 25 0D 57
C0F8:C3 2A 6F C3 24 75 C3 26 B5
C100:F8 C2 29 1B C3 3E 41 C3 E4
C108:1F 0E C2 09 5C C1 28 A1 63
C110:C3 2B A5 C3 31 A9 C3 36 1F
C118:AD C3 17 04 C4 04 14 C4 A9
C120:05 32 C4 06 50 C4 03 6E B5
C128:C4 1E 8C C4 AD 41 C1 18 81
C130:6D 43 C1 A8 90 07 AE 42 3E
C138:C1 E8 4C 40 C1 AE 42 C1 73

```

```

C140:60 00 00 00 AD 59 C1 38 82
C148:ED 5B C1 A8 B0 07 AE 5A B5
C150:C1 CA 4C 58 C1 AE 5A C1 85
C158:60 00 00 00 20 DB C3 A9 AD
C160:BF 85 FB A9 07 85 FC A9 31
C168:E7 85 FD A9 07 85 FE A2 8A
C170:00 A1 FB 81 FD A5 FB 8D FF
C178:59 C1 A5 FC 8D 5A C1 A9 A0
C180:01 8D 5B C1 20 44 C1 84 89
C188:FB 86 FC A5 FD 8D 59 C1 40
C190:A5 FE 8D 5A C1 20 44 C1 D6
C198:84 FD 86 FE A5 FD C9 27 7E
C1A0:D0 CD A5 FE C9 04 D0 C7 6C
C1A8:A9 BF 85 FB A9 DB 85 FC 26
C1B0:85 FE A9 E7 85 FD A2 00 D3
C1B8:A1 FB 81 FD A5 FB 8D 59 AD
C1C0:C1 A5 FC 8D 5A C1 20 44 65
C1C8:C1 84 FB 86 FC A5 FD 00 3E
C1D0:59 C1 A5 FE 8D 5A C1 00 8F
C1D8:44 C1 84 FD 86 FE A5 FD D8
C1E0:C9 27 D0 D2 A5 FE C9 D8 EF
C1E8:D0 CC A9 00 8D F4 C2 A9 AC
C1F0:04 8D F5 C2 8D F7 C2 A9 40
C1F8:27 8D F6 C2 20 BC C2 38 30
C200:20 F0 FF 8A C9 18 F0 05 10
C208:E8 18 20 F0 FF 60 20 DB B8
C210:C3 A9 01 8D 43 C1 A9 00 4F
C218:85 FB A9 04 85 FC 85 FE FE
C220:A9 28 85 FD A2 00 A1 FD 00
C228:81 FB A5 FB 8D 41 C1 A5 7C
C230:FC 8D 42 C1 20 2C C1 00 B5
C238:FB 86 FC A5 FD 8D 41 C1 C1
C240:A5 FE 8D 42 C1 20 2C C1 D6
C248:84 FD 86 FE A5 FD C9 E8 F1
C250:D0 D2 A5 FE C9 07 D0 CC 70
C258:A9 00 85 FB A9 28 85 FD 1A
C260:A9 D8 85 FC 85 FE A2 00 DE
C268:A1 FD 81 FB A5 FB 8D 41 A7
C270:C1 A5 FC 8D 42 C1 20 2C 3E
C278:C1 84 FB 86 FC A5 FD 8D EF
C280:41 C1 A5 FE 8D 42 C1 00 D4
C288:2C C1 84 FD 86 FE A5 FD 7E
C290:C9 E8 00 D2 A5 FE C9 DB 15
C298:D0 CC A9 C0 8D F4 C2 A9 6A
C2A0:07 8D F5 C2 8D F7 C2 A9 73
C2A8:E7 8D F6 C2 20 BC C2 38 42
C2B0:20 F0 FF 8A F0 05 CA 18 74
C2B8:20 F0 FF 60 AD F4 C2 85 DC
C2C0:FB AD F5 C2 85 FC A9 20 2E
C2C8:A2 00 81 FB A5 FB C0 F6 3F
C2D0:C2 F0 19 A9 01 8D 43 C1 38
C2D8:A5 FB 8D 41 C1 A5 FC 8D 22
C2E0:42 C1 20 2C C1 84 FB 86 00
C2E8:FC AC C6 C2 A5 FC CD F7 B9
C2F0:C2 D0 E8 60 00 00 00 2E
C2F8:A9 00 85 D4 85 D8 60 00 C1
C300:DB C3 38 20 F0 FF A0 00 38
C308:18 20 F0 FF 60 20 DB C3 C0
C310:38 20 F0 FF A0 27 18 20 C0
C318:F0 FF 60 A9 00 85 CF A5 1A
C320:D1 8D F4 C2 8D 41 C1 A5 59
C328:D2 8D F5 C2 8D 42 C1 A5 06
C330:D3 8D 43 C1 20 2C C1 8C 4B
C338:F6 C2 8E F7 C2 20 BC C2 10
C340:60 A9 00 85 CF A5 D1 8D 01
C348:41 C1 A5 D2 8D 42 C1 A5 61
C350:D3 8D 43 C1 20 2C C1 8C 6B
C358:F4 C2 8E F5 C2 A9 27 8D D4
C360:43 C1 20 2C C1 8C F6 C2 B1
C368:8E F7 C2 20 BC C2 60 A9 EA
C370:FF 8D F7 E8 60 A9 1A 8D 54
C378:F7 E8 60 A9 00 85 CF A5 38
C380:D1 8D F4 C2 8D 41 C1 A5 B9
C388:D2 8D F5 C2 8D 42 C1 A9 6A
C390:27 8D 43 C1 20 2C C1 8C 55
C398:F6 C2 8E F7 C2 20 BC C2 70
C3A0:60 E8 20 D0 60 CE 20 D0 74
C3A8:60 E8 21 D0 60 CE 21 D0 9E
C3B0:60 A5 D1 8D 41 C1 A5 D2 14
C3B8:8D 42 C1 A5 D3 8D 43 C1 47
C3C0:20 2C C1 8C F4 C2 8E F5 2A
C3C8:C2 A9 E7 8D F6 C2 A9 07 0F
C3D0:8D F7 C2 20 BC C2 A9 00 00
C3D8:85 CF 60 A5 CF C9 01 D0 F5
C3E0:1E A5 D1 8D 41 C1 A5 D2 23

```



```

C3E8:8D 42 C1 A5 D3 8D 43 C1 77
C3F0:20 2C C1 11 FB 86 FC A2 AA
C3F8:00 A1 FB 49 80 81 FB A9 A8
C400:00 B5 CF 60 A9 11 8D 20 8B
C408:D0 A9 06 8D 21 D0 A9 03 A0
C410:8D 86 02 60 A2 00 BD 27 FF
C418:C4 C9 00 F0 07 00 77 02 25
C420:E8 4C 16 C4 86 C6 60 00 50
C428:31 41 41 41 41 41 41 41 A9
C430:41 00 A2 00 BD 45 C4 C0 05
C438:00 F0 07 9D 77 02 E8 4C 9A
C440:34 C4 86 C6 60 11 33 41 FC
C448:41 41 41 41 41 41 41 00 90
C450:A2 00 BD 63 C4 C9 00 F0 57
C458:07 9D 77 02 E8 4C 52 C4 BD
C460:86 C6 60 00 35 41 41 41 5D
C468:41 41 41 41 41 00 A2 00 6E
C470:BD 81 C4 C9 11 F0 07 9D DD
C478:77 02 E8 4C 70 C4 86 C6 8A
C480:60 00 37 41 41 41 41 00
C488:41 41 41 11 60 00 00 00 2E

```

Program 2: Keyboard Enhancer Customizer

```

HE 10 REM COPYRIGHT 1988 COMPU
TEI PUBLICATIONS, INC. -
ALL RIGHTS RESERVED
CX 20 POKE53280,6:POKE53281,6:
POKE646,3
JG 30 PRINT"[CLR]{3 SPACES}CO
YRIGHT 1988 COMPUTE! PUB
., INC."
FB 40 PRINTTAB(11)"ALL RIGHTS
{SPACE}RESERVED"
RD 50 PRINT"{2 DOWN}{4 SPACES}
'KEYBOARD ENHANCER' CUST
OMIZER"
CP 60 PRINT"{2 DOWN}{RVS}FUNCT
ION KEY STRINGS"
BS 70 PRINT"{DOWN}CURRENT STRI
NGS{DOWN}"
BJ 80 FORJ=1TO7STEP2
QK 90 PRINT"F";J;" ";CHR$(34);
:READA:ZZ=A:GOSUB260
QA 100 PRINT"NEW DEFINITION:?"
;:D$=""
HM 110 POKE204,0:GETS$:IF$=""
THEN110
RC 120 IF$=CHR$(13)THEN160
QX 130 POKE212,1:PRINT$;:D$=D
$+$S$
QS 140 IF$=CHR$(20)THEND$=LEF
T$(D$,LEN(D$)-2)
HM 150 GOTO110
MR 160 PRINT" ";
DR 170 PRINT:IFLEN(D$)>10THEN1
10
DK 180 A=ZZ:GOSUB320
FF 190 PRINT" ";NEXTJ
GD 200 PRINT"{DOWN}{RVS}DEFAUL
T COLORS"
JC 210 FORJ=1TO3
MF 220 READL$:PRINT"CURRENT ";
L$;" ";
SB 230 READB:PRINTPEEK(B)
QX 240 INPUT"NEW VALUE:";X:IFX
<0ORX>255THEN240
HX 250 POKEB,X:NEXTJ
EH 260 IFPEEK(A)=0THEN310
GK 270 IFPEEK(A)=13THENF$="4":
GOTO300
PB 280 IFPEEK(A)=34THENF$=CHR$
(39):GOTO300
MX 290 F$=CHR$(PEEK(A))
EQ 300 PRINTF$;:A=A+1:GOTO260
MK 310 PRINTCHR$(34):RETURN
RP 320 IF0$=""THENRETURN
FS 330 FORT=1TOLEN(D$)
PJ 340 IFMID$(D$,T,1)="4"THENF
$=CHR$(13):GOTO370
EP 350 IFMID$(D$,T,1)=CHR$(39)
THENF$=CHR$(34):GOTO370
HR 360 F$=MID$(D$,T,1)

```

```

JA 370 POKEA,ASC(F$):A=A+1
KA 380 NEXTT:POKEA,0:RETURN
KC 390 DATA 50215,50245,50275,
50305
FM 400 DATA "BORDER",50181,"SC
REEN",50186,"CURSOR",50
191

```

Treasure Diver

See instructions in article on page 28 before typing in.

```

C000:A9 11 A2 37 11 FD 86 FE 4E
C008:A9 07 A2 C7 85 FB 86 FC 17
C010:A2 00 A0 00 B1 FB 91 FD 95
C018:C8 C0 3F D0 F7 18 A5 FB 8A
C020:69 3F 85 FB A5 FC 69 00 8A
C028:85 FC 18 A5 FD 69 3F 85 A2
C030:F0 A5 FE 69 11 85 FE E8 8D
C038:D0 D8 A9 00 8D 04 C7 8D 27
C040:05 C7 A9 93 20 D2 FF A9 9A
C048:08 8D 20 D0 A9 11 21 65
C050:D0 A9 FD A0 C5 20 1E AB 05
C058:A0 2F 8D 05 D4 8D 13 D4 CF
C060:A9 F9 8D 06 D4 8D 14 D4 21
C068:A9 11 8D 11 D4 8D 0B D4 38
C070:8D 12 D4 8D 0E D4 A9 0F D6
C078:8D 18 D4 A0 05 8D 08 D4 AE
C080:A9 00 8D 07 D4 A9 22 8D 18
C088:0C D4 A9 F4 8D 0D D4 A9 BD
C090:03 8D 0F D4 A9 A0 A0 6F A6
C098:20 D2 FF 8D D0 FA A0 00 1B
C0A0:B9 D5 C6 99 00 D0 C8 00 7C
C0A8:11 D0 F5 A9 FF 8D 1C D0 7F
C0B0:A9 11 8D 25 D0 8D 17 D0 C6
C0B8:8D 1D 00 8D 1E D0 A9 01 C3
C0C0:8D 26 D0 A0 00 B9 E6 C6 32
C0C8:99 27 D0 B9 EE C6 99 F8 55
C0D0:07 C8 00 11 D0 EF A9 FF 3A
C0D8:8D 15 D0 A9 11 8D ED C5 F2
C0E0:8D F5 C5 8D 02 C7 8D 03 85
C0E8:C7 11 01 C7 A9 14 8D FF 07
C0F0:C6 A9 0A 8D 00 C7 A9 05 D1
C0F8:8D 76 C6 A9 11 8D 06 C7 74
C100:A9 1E 8D 68 C6 11 5F C6 89
C108:A9 14 11 5E C6 A9 01 8D 69
C110:F4 C5 11 06 A9 85 11 ED 78
C118:C5 49 80 88 D0 F8 A9 81 A8
C120:8D F6 C5 8D F8 C5 8D FA AE
C128:C5 A9 01 8D F7 C5 8D F9 DD
C130:C5 8D FB C5 A2 0B A0 0B 63
C138:18 20 F0 FF A9 91 A0 C6 89
C140:20 1E AB 20 E4 FF C9 31 BE
C148:11 F9 C9 35 11 F5 38 E9 D6
C150:31 AB 11 06 C6 8D 40 FF D9
C158:A2 0B A0 B6 18 20 F0 FF 27
C160:A9 A4 A0 C6 20 1E 11 AD E0
C168:11 DC 8D F6 C6 29 01 D0 F1
C170:1B AD F5 C5 9 11 F0 33 75
C178:C9 04 F0 88 A9 82 8D F5 E8
C180:C5 4C AB C1 A9 01 8D F5 ED
C188:C5 4C AB C1 AD F6 C6 29 93
C190:02 D0 18 AD F5 C5 C9 04 85
C198:11 C9 82 F0 88 A9 04 39
C1A0:8D F5 C5 4C AB C1 A9 01 9E
C1A8:8D F5 C5 AD F6 C6 29 04 2D
C1B0:D0 18 AD E0 C5 C9 83 F0 45
C1B8:33 C9 03 F0 88 A9 83 8D 33
C1C0:EC C5 4C EC C1 A9 00 8D 47
C1C8:ED C5 4C EC C1 AD F6 C6 86
C1D0:29 08 D0 18 AD ED C5 C9 01
C1D8:03 F0 11 C9 83 F0 88 A9 72
C1E0:11 8D ED C5 4C EC C1 A9 A6
C1E8:08 8D ED C5 AD F6 C6 29 E9
C1F0:10 F0 0D A9 00 11 77 C6 E0
C1F8:A9 80 8D 12 D4 4C 0A C2 F2
C200:A9 01 8D 77 C6 A9 81 8D 31
C208:12 D4 A9 04 8D E9 C5 AD 8E
C210:E9 C5 0A 8D E7 C5 AC E7 AD
C218:C5 AE E9 C5 C4 B9 01 D0 D5
C220:ED F7 C6 80 0C E8 BD F5 EB
C228:C5 29 7F 9D F5 C5 4C 3F 43
C230:C2 DD FB C6 90 09 E8 BD B2

```

```

C238:F5 C5 09 80 9D F5 C5 CE 72
C240:E9 C5 D0 CB A9 05 8D E9 69
C248:C5 38 AD E9 C5 E9 05 AA 9D
C250:DE FF C6 F0 03 4C F2 C2 1F
C258:AD 01 C7 0A 8D E5 C5 38 56
C260:A9 15 ED E5 C5 9D FF C6 87
C268:AD E9 C5 0A 8D EA C5 AD E9
C270:00 D0 8D E5 C5 AD 10 D0 10
C278:29 01 8D E6 C5 AC EA C5 6F
C280:B9 00 D0 8D E7 C5 AC E9 6F
C288:C5 AD 10 D0 39 C5 C6 F0 CA
C290:02 A9 01 8D E8 C5 38 AD F6
C298:E5 C5 ED E7 C5 8D EB C5 C0
C2A0:AD E6 C5 ED E8 C5 0D EB B2
C2A8:C5 90 13 AC E9 C5 8D ED 2A
C2B0:C5 29 7F 99 ED C5 A9 E0 A7
C2B8:99 FB 07 4C CE C2 AC E9 83
C2C0:C5 B9 ED C5 09 80 99 ED 1D
C2C8:C5 A9 DE 99 F8 07 AC EA 39
C2D0:C5 B9 01 D0 CD 01 D0 B0 99
C2D8:0E AC E9 C5 B9 F5 C5 29 84
C2E0:7F 99 F5 C5 4C F2 C2 AC 08
C2E8:E9 C5 B9 F5 C5 09 80 99 58
C2F0:F5 C5 EE E9 C5 AD E9 C5 DD
C2F8:C9 07 F0 03 4C 49 C2 A9 2A
C300:00 8D E9 C5 CE 06 C7 AC 4F
C308:E9 C5 AD 06 C7 D0 80 89 57
C310:F0 07 49 01 99 F8 07 AD 7B
C318:E9 C5 20 E5 C4 EE E9 C5 E3
C320:AD E9 C5 C9 07 D0 E0 20 AB
C328:E5 C4 AD 77 C6 F0 05 A9 AE
C330:00 20 E5 C4 AD 06 C7 D0 AE
C338:05 A9 03 8D 06 C7 20 D8 4E
C340:C4 A5 C5 C9 03 F0 2E AD CE
C348:8E 02 F0 36 A2 0B A0 E0 A9
C350:18 20 F0 FF A9 78 A0 C6 41
C358:20 1E AB 20 D8 C4 AD 8E B2
C360:02 1E AB 20 8B A0 0E 18 D5
C368:20 F0 FF A9 85 A0 C6 20 33
C370:1E AB 4C 82 C3 A9 00 8D F5
C378:15 D0 85 C6 A9 93 20 D2 8A
C380:FF 60 A9 10 8D 04 D4 AD 2A
C388:01 D0 C9 55 D0 16 AD 5E EB
C390:C6 C9 14 F0 40 EE 5E C6 C0
C398:AC 5E C6 B9 61 C6 99 03 DE
C3A0:D8 4C C5 C3 AD 77 C6 D0 46
C3A8:0B CE 5F C6 D0 27 AD 60 A0
C3B0:C6 8D 5F C6 CE 5E C6 D0 A5
C3B8:03 4C AC C4 AC 5E C6 C8 EB
C3C0:A0 00 99 03 D8 18 AD 5E 61
C3C8:C6 0A 0A 69 0A 8D 01 D4 6B
C3D0:A9 11 8D 04 D4 A9 00 8D 3E
C3D8:0B D4 AD 1E D0 8D E5 C5 01
C3E0:29 01 D0 03 4C 89 C4 AD 47
C3E8:E5 C5 29 80 D0 03 4C 7A A7
C3F0:C4 AD 01 D0 C9 7D B0 03 1C
C3F8:4C 89 C4 18 AD 02 C7 69 91
C400:C8 8D 02 C7 AD 03 C7 69 80
C408:00 8D 03 C7 A2 01 A0 06 32
C410:18 20 F0 FF A9 12 20 D2 74
C418:FF AD 03 C7 AE 02 C7 20 17
C420:CD BD 38 AD 02 C7 ED 04 F0
C428:C7 8D E5 C5 AD 03 C7 ED 09
C430:05 C7 0D E5 C5 90 0C AD 64
C438:02 C7 8D 04 C7 AD 03 C7 11
C440:8D 05 C7 A2 02 A0 08 18 AF
C448:20 F0 FF A9 12 11 D2 FF 6F
C450:AD 05 C7 AE 04 C7 20 CD 23
C458:BD A9 7F 8D 15 D0 A9 5A 8D
C460:8D F4 C5 A9 07 20 E5 C4 8A
C468:A9 01 8D F4 C5 A9 FF 8D 6A
C470:15 D0 A9 21 8D 0B D4 4C 8E
C478:89 C4 A9 81 8D 0B D4 AD 35
C480:60 C6 C9 01 F0 03 CE 60 C6
C488:C6 AD 1E D0 A9 00 1E 38
C490:8D 20 DE FF E0 07 90 11 BB
C498:A9 00 AA A8 20 DB FF AD F4
C4A0:01 C7 C9 0A F0 03 EE 01 E8
C4A8:C7 4C 67 C1 A9 00 8D 18 B2
C4B0:D4 8D 04 D8 A2 0B A0 0E A6
C4B8:18 20 F0 FF A9 BA A0 C6 B4
C4C0:20 1E AB A9 FF 8D 40 03 AB
C4C8:A9 8A 8D E5 C5 20 D0 C4 DE
C4D0:CE E5 C5 D0 F8 4C 42 C0 3F
C4D8:AC 40 03 AE 40 03 CA D0 88

```

```

C4E0:FD 00 D0 F7 60 8D E5 C5 00
C4E8:0A 8D E7 C5 AE E5 C5 BD 8A
C4F0:ED C5 29 7F F0 14 A8 AE D7
C4F8:E5 C5 BD ED C5 29 80 F0 42
C500:06 20 55 C5 4C 0A C5 20 D3
C508:9E C5 AE E5 C5 BD F5 C5 5F
C510:29 7F F0 14 A8 AE E5 C5 01
C518:BD F5 C5 29 80 F0 06 20 3F
C520:29 C5 4C 20 C5 20 3F C5 B0
C528:60 AE E7 C5 DE 01 D0 BD 43
C530:01 D0 C9 55 B0 05 A9 55 41
C538:9D 01 D0 88 D0 EE 60 AE 27
C540:E7 C5 FE 01 D0 BD 01 D0 71
C548:C9 F0 90 05 A9 F0 9D 01 A4
C550:D0 88 D0 EE 60 AE E7 C5 C2
C558:DE 00 D0 AE E5 C5 AD 10 0A
C560:D0 3D C5 C6 D0 1E AE E7 0D
C568:C5 BD 00 D0 C9 19 B0 2A 91
C570:A9 46 9D 00 D0 AE E5 C5 E8
C578:AD 10 D0 1D C5 C6 8D 10 3F
C580:D0 4C 9A C5 AE E7 C5 BD 95
C588:00 D0 C9 FF D0 0C AE E5 7B
C590:C5 AD 10 D0 3D C0 C6 8D B5
C598:10 D0 88 D0 B0 60 AE E7 0B
C5A0:C5 FE 00 D0 AE E5 C5 AD 22
C5A8:10 D0 3D C5 C6 D0 17 AE CA
C5B0:E7 C5 BD 00 D0 D0 2A AE 26
C5B8:E5 C5 AD 10 D0 1D C5 C6 AC
C5C0:8D 10 D0 4C E1 C5 AE E7 61
C5C8:C5 BD 00 D0 C9 46 90 11 4D
C5D0:A9 19 9D 00 D0 AE E5 C5 FD
C5D8:AD 10 D0 3D C0 C6 8D 10 E1
C5E0:D0 88 D0 BA 60 00 00 00 BF
C5E8:00 00 00 00 00 00 00 74
C5F0:00 00 00 00 00 00 00 7C
C5F8:00 00 00 00 00 93 90 12 06
C600:41 49 52 3A 1C 20 20 20 30
C608:20 9E 20 20 20 20 20 1E 33
C610:20 20 20 20 20 20 20 9D
C618:20 20 20 9F 20 20 20 9D
C620:20 20 20 20 20 20 20 AD
C628:20 20 20 20 53 43 4F 52 6C
C630:45 3A 30 20 20 20 20 D8
C638:20 20 20 20 20 20 20 C5
C640:20 20 20 20 20 20 20 D0
C648:20 20 20 20 20 20 20 D5
C650:20 20 20 20 48 49 53 43 4D
C658:4F 52 45 3A 30 00 00 00 EF
C660:00 00 02 02 02 02 07 07 7B
C668:07 07 07 05 05 05 05 05 B7
C670:05 05 05 05 05 05 00 00 EE
C678:92 47 41 4D 45 20 50 41 AA
C680:55 53 45 44 00 20 20 20 5B
C688:20 20 20 20 20 20 20 16
C690:00 92 45 4E 54 45 52 20 CC
C698:53 50 45 45 44 20 28 31 05
C6A0:2D 34 29 00 20 20 20 20 D8
C6A8:20 20 20 20 20 20 20 36
C6B0:20 20 20 20 20 00 41 50 30
C6B8:64 7D 92 47 41 4D 45 20 88
C6C0:4F 56 45 52 00 01 02 04 65
C6C8:08 10 20 40 80 FE FD FB 5E
C6D0:F7 EF DF BF 7E 64 55 19 9F
C6D8:69 46 8C 64 BA 1E DC 19 75
C6E0:E1 46 55 5A E9 54 0E 0E 0C
C6E8:0E 0E 0E 00 00 07 DC E0 79
C6F0:DF E0 DE E1 DF E2 00 56 81
C6F8:78 A0 C8 7D A0 C8 F0 00 E5
C700:00 00 00 00 00 00 0A 99
C708:80 00 2A A0 00 AA E8 00 A3
C710:AA A8 00 AA A8 00 AA A8 0D
C718:00 2A A0 00 A8 00 00 05 9D
C720:40 00 1D 00 00 00 00 00 00
C728:00 00 00 00 00 00 00 B7
C730:00 00 00 00 00 00 00 BF
C738:00 00 00 00 00 00 00 C7
C740:00 00 00 00 00 00 FF 0A D9
C748:00 00 2A A0 00 AA E8 00 E3
C750:AA A8 00 AA A8 00 AA A8 4D
C758:00 2A A0 00 A8 00 00 05 DD
C760:40 00 37 70 00 00 00 00 FD
C768:00 00 00 00 00 00 00 F7
C770:00 00 00 00 00 00 00 FF
C778:00 00 00 00 00 00 00 08
C780:00 00 00 00 00 00 FF 00 10

```

```

C788:80 00 A2 60 00 EA A0 80 20
C790:8E A8 80 00 AA 80 00 A8 61
C798:80 CE 80 80 A8 00 00 79
C7A0:00 00 00 00 00 00 00 30
C7A8:00 00 00 00 00 00 00 38
C7B0:00 00 00 00 00 00 00 40
C7B8:00 00 00 00 00 00 00 48
C7C0:00 00 00 00 00 00 FF 00 50
C7C8:80 00 02 60 00 02 A0 20 48
C7D0:AA A8 80 FF AA 80 FF A8 EF
C7D8:80 AA 00 20 00 00 00 55
C7E0:00 00 00 00 00 00 00 70
C7E8:00 00 00 00 00 00 00 78
C7F0:00 00 00 00 00 00 00 80
C7F8:00 00 00 00 00 00 00 88
C800:00 00 00 00 00 00 FF 00 91
C808:20 00 00 90 A0 20 AA B0 BE
C810:22 AB 00 2A A0 00 22 A0 2A
C818:00 20 2B 30 00 02 A0 00 63
C820:00 00 00 00 00 00 00 81
C828:00 00 00 00 00 00 00 B9
C830:00 00 00 00 00 00 00 C1
C838:00 00 00 00 00 00 00 C9
C840:00 00 00 00 00 00 00 D1
C848:00 00 00 98 00 80 A8 00 C6
C850:22 AA A0 2A AF F0 22 AF 8D
C858:F0 80 80 A0 00 00 00 89
C860:00 00 00 00 00 00 00 F1
C868:00 00 00 00 00 00 00 F9
C870:00 00 00 00 00 00 00 02
C878:00 00 00 00 00 00 00 0A
C880:00 00 00 00 00 00 00 12
C888:00 00 00 00 00 00 00 1A
C890:00 00 00 00 35 FC 00 35 B8
C898:5C 00 D5 5C 00 FD 5C 03 8C
C8A0:AB F0 0E AA B0 0F EA F0 39
C8A8:0D 7F 70 0D 57 70 00 57 6D
C8B0:7F 0D 57 70 0F D7 C8 00 09
C8B8:3F 00 00 00 00 00 00 E9
C8C0:00 00 00 00 00 00 FF 00 52

```

Relative Ease

See instructions in article on page 74 before typing in.

Relative Ease

```

C000:20 33 A5 A4 23 A5 22 18 69
C008:69 02 90 01 C0 85 2D 84 1C
C010:2E 85 2F 84 30 85 31 84 B6
C018:32 AD 00 03 8D 69 C0 AD 8F
C020:01 03 8D 6A C0 A9 C0 8D F6
C028:01 03 A9 78 8D 00 03 A9 C3
C030:7A 8D 11 03 A9 C2 8D 12 2A
C038:03 8D 52 45 4C 41 54 49 4B
C040:56 45 20 45 41 53 45 20 98
C048:42 59 20 4A 45 46 46 20 D9
C050:50 41 52 54 43 48 20 28 7D
C058:43 29 31 39 30 37 20 43 A1
C060:4F AD 50 55 54 45 21 00 36
C068:4C FF FF 9F A0 52 45 43 26
C070:B0 44 C0 F4 C1 F3 C2 27 4D
C078:E0 6B D0 EC 68 C9 B0 D0 B2
C080:E7 08 C9 A9 D0 E2 A9 01 4A
C088:85 7B A4 3A 84 7A C8 F0 74
C090:10 A5 3D 85 7A A5 3E 85 EF
C098:7B A0 00 B1 7A D0 02 A0 D6
C0A0:04 20 FB A8 A2 02 20 73 07
C0A8:00 C9 8B D0 09 20 73 00 CA
C0B0:C9 A7 D0 F9 F0 F0 C9 44 DD
C0B8:D0 16 20 73 00 CA 30 07 F5
C0C0:DD 6B C0 F0 16 D0 F6 A2 B7
C0C8:0B 4C 68 C0 E8 20 73 00 AA
C0D0:DD 6B C0 D0 F2 C9 44 D0 59
C0D8:F3 A2 02 8A 0A AA BD 72 CE
C0E0:C0 48 BD 73 C0 48 A9 08 46
C0E8:85 BA 4C 73 00 A2 08 2C 63
C0F0:A2 17 4C 68 C0 F0 D0 20 25
C0F8:C4 C1 20 FD AE 20 9E AD 12
C100:20 A3 B6 F0 E8 C9 11 B0 A3
C108:E7 85 B7 A0 00 B1 22 99 86
C110:3A C0 C8 C4 B7 D0 F6 20 55
C118:79 00 F0 49 A9 00 8D 67 DA
C120:C0 20 FD AE A9 4C D0 18 EF

```

```

C128:20 D2 C1 20 B1 C1 A4 B7 40
C130:99 3A C0 8D 67 C0 E6 B7 C3
C138:20 79 00 F0 28 20 FD AE A5
C140:C9 55 00 00 20 A0 C1 20 EF
C148:79 00 F0 19 20 FD AE C9 58
C150:57 D0 0F 20 D2 C1 AD 67 F7
C158:C0 D0 07 C6 B7 20 73 00 E2
C160:F0 03 4C C7 C0 A0 01 C8 76
C168:98 09 60 A6 98 CA 30 07 48
C170:DD 62 03 F0 F2 D0 F6 85 39
C178:B9 A5 B7 A0 C0 A2 3A 20 68
C180:BD FF 20 C0 FF 90 18 AA 10
C188:4C 68 C0 A0 00 A5 BA 84 FE
C190:90 20 B1 FF A9 6F 20 93 79
C198:FF A9 05 24 90 30 E8 60 E0
C1A0:20 73 00 20 9E B7 E0 08 B0
C1A8:90 15 E0 1F B0 11 86 BA 59
C1B0:60 20 73 00 20 9E B7 8A 50
C1B8:F0 05 C9 FF F0 01 60 A2 1E
C1C0:0E 4C 68 C0 A9 23 20 FF 91
C1C8:AE 20 9E B7 8A F0 F0 86 7B
C1D0:B8 60 A4 B7 99 3B C0 A9 BD
C1D8:2C 99 3A C0 99 3C C0 E6 52
C1E0:B7 E6 B7 E6 B7 60 C9 91 C3
C1E8:D0 40 20 73 00 C9 55 D0 C2
C1F0:39 4C A0 C1 F0 17 C9 23 EE
C1F8:D0 10 20 C4 C1 20 79 00 BA
C200:F0 03 20 E6 C1 A5 B8 4C 93
C208:C3 FF 20 E6 C1 A6 98 A9 65
C210:00 40 CA 30 0F BD 63 02 3C
C218:C5 BA D0 F6 BD 59 02 D0 E0
C220:F0 20 C3 FF 68 D0 FA 60 7B
C228:D0 03 4C C7 C0 20 C4 C1 AE
C230:8A 20 14 F3 F0 05 A2 03 A8
C238:4C 68 C0 09 60 8D 3B C0 17
C240:BD 63 02 B5 BA A9 50 8D C0
C248:3A C0 20 FD AE 20 9E AD DF
C250:20 F7 B7 8C 3C C0 8D 3D E0
C258:C0 A2 01 20 79 00 F0 06 BC
C260:20 FD AE 20 B4 C1 E0 3E 55
C268:C0 20 8B C1 B9 3A C0 20 3C
C270:A8 FF C0 C0 05 D0 F5 4C 13
C278:AE FF 20 A1 87 20 A6 C1 C0
C280:20 88 C1 20 AE FF A5 BA AE
C288:20 B4 FF A9 6F 20 96 FF 0F
C290:20 AD F1 48 84 B7 C8 24 D0
C298:90 50 F5 98 20 7D B4 A4 C7
C2A0:B7 68 91 62 88 10 FA 68 57
C2A8:60 20 CA B4 4C AB FF 00 20

```

Periscope

Article on page 70.

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HE 10 REM COPYRIGHT 1988 COMPU
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KH 20 GOSUB620
HH 30 PRINT "[HOME]DRIVE TYPE"
:PRINT"A 1581":PRINT"B 1
571":PRINT"C 1541{DOWN}"
ER 40 PRINT"{UP}PRESS A, B, OR
C"
DF 00 GETKEYTYS:IFTYS<"A"ORTYS
>"C"THEN40
RF 60 INPUT "DEVICE NUMBER
{2 RIGHT}8{3 LEFT}";DR:I
F DR<0 OR DR>11 THEN 60
DB 70 OPEN15,DR,15:OPEN5,DR,5,
"0":OPEN4,DR,4,"0":GOTO2
50
JF 80 INPUT "TRACK AND SECTOR
{SPACE}NUMBER";TR,SE
QH 90 IFTYS="A"AND (TR<10TR>80
ORSE<0ORSE>39)THENRETURN
OX 100 IFTYS<"B"THEN150
QJ 110 IF (TR<10TR>70ORSE<0ORS
E>20)THENRETURN
BC 120 IF ((TR>17ANDTR<25)OR (TR
>52ANDTR<60))ANDSE>18TH
ENRETURN
CH 130 IF ((TR>24ANDTR<31)OR (TR
>59ANDTR<66))ANDSE>17TH

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ENRETURN
SE 140 IF((TR>30ANDTR<36)OR(TR
>65ANDTR<71))ANDSE>16TH
ENRETURN
KX 150 IFTY$<>"C"THEN200
QS 160 IFTR<10TR>35ORSE<0ORSE
>20THENRETURN
MK 170 IFTR>17ANDTR<25ANDSE>18
THENRETURN
RH 180 IFTR>24ANDTR<31ANDSE>17
THENRETURN
DP 190 IFTR>30ANDSE>16THENRETU
RN
MP 200 PRINT#15,"U1";5;0;TR;SE
FA 210 SYS4864
FG 220 BK(PO)=PEEK(1024):BK(PO
+1)=PEEK(1025):PO=PO+2:
IFPO>51THENPO=0
KG 230 IFPO>LITHELI=PO
MF 240 RETURN
RX 250 GOSUB600:PRINTME$:PRINT
"TRACK "TR;" SECTOR "SE
XJ 260 GET C$:IFC$=""THEN 260
BP 270 IFC$="C"THENGOSUB590
XC 280 IFC$="E"THENGOSUB330
ES 290 IFC$="N"THENGOSUB80
EK 300 IFC$="B"THENGOSUB570
QC 310 IFC$="Q"THEN600
CH 320 GOTO250
CG 330 WINDOW 0,0,39,7:CL=0
QX 340 GOSUB530:GETIN$:IFIN$=""
THEN340
KC 350 IN=ASC(IN$):IFIN=13THEN
550
CG 360 IFIN=27THENRETURN
AR 370 IFIN=19THEN330
KF 380 IFIN=67ANDPEEK(211)=8TH
ENTR=PEEK(C1):SE=PEEK(C
1+1):GOSUB90:POKE200,0:
GOTO330
SK 390 IFIN=66ANDPEEK(211)=8TH
ENGOSUB570:POKE200,0:GO
TO330
PX 400 IFIN=17ANDCL<215THENCL=
CL+40:GOTO470
EH 410 IFIN=29ANDCL<255THEN460
BF 420 IFIN=145ANDCL>39THENCL=
CL-40:GOTO470
BK 430 IFIN=157ANDCL>0THENCL=C
L-1:GOTO470
HP 440 IFIN=180RIN=146THEN470
EF 450 IFIN<320R(IN)>127ANDIN<1
60)THEN340
EH 460 CL=CL+1:IFCL>256THEN330
DA 470 POKE7,(CL-1024)/40
SE 480 C2=(CL-1024)
KK 490 IFC2>39THENC2=C2-40:GOT
O490
JJ 500 POKE8,C2
JR 510 POKE5,PEEK(5)AND254:SYS
65520
BM 520 PRINTIN$;:GOTO340
SG 530 C1=1024+CL:C2=PEEK(C1):
POKEC1,XOR(C2,128):C3=P
EEK(C1+1):C4=C2+C3*256
SR 540 POKEC1,C2:POKE8,19:POKE
7,7:POKE5,PEEK(5)AND254
:SYS65520
QR 545 PRINT"(CYN){2 LEFT}"C2"
{LEFT}"($"RIGHT$(HEX$(C2
),2)"")"C4"{LEFT}"($"HEX$(
C4)"")"5 SPACES":RETUR
N
RH 550 SYS4883
RC 560 PRINT#15,"U2";4;0;TR;SE
:RETURN
HJ 570 PO=PO-4:IFPO<0THENPO=LI
FR 580 TR=BK(PO):SE=BK(PO+1):S
LEEP:GOTO90
FH 590 TR=PEEK(1024):SE=PEEK(1
025):GOTO90
FF 600 INPUT#15,A,B$,C,D:PRINT
A;B$;C;D:CLOSE4:CLOSE5:

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CLOSE15:PRINT"(2 HOME)
{CLR}":POKE248,0
EB 610 SYS4944:END:REM ENABLE
(SPACE)STOP KEY AND RUN
/STOP-RESTORE
QD 620 PO=0:DIM BK(51):PRINTCH
R$(14)CHR$(8):POKE248,1
92:TR=1:SE=0
AS 630 POKE53280,0:POKE53281,0
:PRINT"(CLR){CYN}
{3 SPACES}COPYRIGHT 190
8 COMPUTE! PUB., INC."
KK 640 PRINTTAB(11)"ALL RIGHTS
RESERVED"
RE 650 RE$=CHR$(13):ME$="C CON
TINUE"+RE$+"Q QUIT"+RE$
+"E EDIT"+RE$+"N NEW"+R
E$+"B BACK"+RE$+"(DOWN)
PRESS KEY"
JH 660 RESTORE:FORI=0TO114:REA
DA:POKE4864+I,A:B=B+A
GQ 670 NEXT:I:IFB<>12696THENPRIN
T"(2 HOME){CLR}{RED}ERR
OR{2 SPACES}IN DATA STA
TEMENTS":END
BF 680 WINDOW 0,16,39,24,1
GK 690 SYS4919:RETURN:REM DISA
BLE STOP AND RUN/STOP-R
ESTORE
XF 700 DATA162,005,032,198,255
BE 710 DATA160,000,032,207,255
FB 720 DATA153,000,004,200,208
EE 730 DATA247,076,204,255,162
GP 740 DATA004,032,201,255,160
BB 750 DATA000,185,001,004,032
PJ 760 DATA210,255,200,192,255
BK 770 DATA144,245,173,000,004
BS 780 DATA032,210,255,076,204
KX 790 DATA255,165,005,041,253
XQ 800 DATA133,005,165,145,096
BB 810 DATA120,169,051,141,024
DB 820 DATA003,169,255,141,025
AQ 830 DATA003,169,046,141,040
KX 840 DATA003,169,019,141,041
PF 850 DATA003,088,096,000,000
EK 860 DATA120,169,064,141,024
FJ 870 DATA003,169,250,141,025
RH 880 DATA003,169,110,141,040
DE 890 DATA003,169,246,141,041
DS 900 DATA003,088,096,082,079
XX 910 DATA066,069,082,084,032
HF 920 DATA066,073,088,066,089

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Trap

See instructions in article on page 26 before typing in.

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0001:00 00 0A 00 9E 32 30 36 2E
0009:31 00 00 00 A9 00 8D 21 3B
0011:00 8D 20 D0 85 50 85 51 C7
0019:A9 00 20 D2 FF A9 8E 20 15
0021:D2 FF AD 11 D0 09 40 8D 1A
0029:11 D0 A9 00 8D 0E DC A9 33
0031:73 85 01 A0 00 B9 00 D0 3E
0039:99 00 38 B9 00 D1 99 00 33
0041:39 88 D0 F1 A9 77 85 01 80
0049:A9 01 8D 0E DC A9 66 8D E8
0051:82 39 8D 83 39 B9 8E 11 B9
0059:99 00 39 C8 C0 38 F5 6A
0061:A9 1F 8D 18 D0 A0 00 B9 04
0069:C6 11 99 D0 39 C8 C0 20 EF
0071:D0 F5 A0 00 98 99 00 D4 7B
0079:99 06 13 C8 C0 18 D0 F5 C4
0081:A9 FF 8D 0F D4 A9 80 8D E4
0089:12 D4 A9 93 20 D2 FF A9 3C
0091:01 8D 22 D0 A0 FF 8C 27 1C
0099:13 C8 8C 26 13 B9 78 12 DB
00A1:99 4C 05 B9 87 12 99 74 F9
00A9:05 B9 96 12 99 EC 05 A9 D2
00B1:0F 99 4C D9 A9 03 99 EC 50
00B9:D9 A9 0C 99 74 D9 C8 C0 99
00C1:0F D0 DA A0 00 B9 A5 12 37

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00C9:99 87 06 A9 0F 99 87 DA AC
00D1:C8 C0 1A D0 F0 20 31 11 42
00D9:A9 80 8D 05 D4 8D 06 D4 9E
00E1:8D 0C D4 8D 0D D4 A9 21 5F
00E9:8D 04 D4 8D 0B D4 A9 03 37
00F1:8D 01 D4 8D 08 D4 A9 05 68
00F9:8D 00 D4 A9 1F 8D 18 D4 3A
0001:A9 F3 8D 17 D4 A0 4A A2 60
0009:00 CA D0 FD AD 00 DC C9 B8
0011:6F F0 38 88 D0 F3 20 68 A8
0019:0C AE 27 13 AD 26 13 D0 EF
0021:18 CA CA CA E0 63 F0 09 77
0029:8E 16 D4 8E 27 13 4C 06 AF
0031:09 A9 01 8D 26 13 4C 29 6A
0039:09 E8 E8 E8 E8 FF F0 03 A1
0041:4C 29 09 A9 08 D0 26 13 15
0049:4C 29 09 A2 00 8E 5A 13 19
0051:8E 01 D4 86 2A 8E 00 D4 4E
0059:E8 8E 5B 13 A9 E1 8D 21 31
0061:13 A9 06 8D 22 13 A9 60 12
0069:8D 25 13 A9 93 20 D2 FF 4B
0071:A9 09 8D 29 13 85 29 A9 89
0079:0A 8D 52 13 A9 8D 8D 51 49
0081:13 A9 0A 8D 5C 13 A9 03 27
0089:8D 5D 13 A0 00 84 4E 84 59
0091:4F B9 69 12 99 00 04 B9 96
0099:6E 12 99 1D 04 B9 73 12 6C
00A1:99 C0 07 A9 0C 99 C0 D8 CB
00A9:99 1D D8 99 C0 D8 C0 4C
00B1:05 D0 DE A9 13 20 D2 FF AF
00B9:A9 06 85 D3 A9 0F 8D 86 3B
00C1:02 A6 4E A5 4F 20 CD BD F6
00C9:A9 22 85 D3 A6 50 A5 51 3A
00D1:20 CD BD A9 3A 8D 13 04 E8
00D9:8D 15 04 A9 01 8D 13 D8 50
00E1:8D 15 D0 A0 00 8D 99 40 FA
00E9:39 C8 C0 40 D0 F8 A0 FF 92
00F1:84 28 C8 A5 28 99 42 39 29
00F9:99 43 39 99 44 39 06 28 A5
0001:18 98 69 08 A8 C0 40 D0 8E
0009:EA A9 00 A8 99 00 30 C8 7D
0011:C0 80 D0 F8 A0 00 B9 31 F8
0019:12 99 01 30 B9 4D 12 99 80
0021:41 30 C8 C0 1C D0 EF A0 AB
0029:24 A9 28 99 C4 07 A9 0F FC
0031:99 C4 DB 8D D0 F3 A9 23 14
0039:8D 23 13 A9 28 8D 24 13 AC
0041:B9 BF 12 99 2D 13 C8 C0 06
0049:24 D0 F5 A9 1C 85 52 A9 42
0051:0E 85 58 A9 41 8D 0B D4 9E
0059:A9 8C 8D 16 D4 A9 F1 8D 37
0061:17 D4 AE 5A 13 BD 0D 12 6D
0069:A9 00 8C 2B 13 8C 28 13 40
0071:8C 2A 13 8C 53 13 99 06 A1
0079:13 C8 C0 08 D0 F8 BD 15 DC
0081:12 8D 0F 13 8D 10 13 8D 75
0089:11 13 BD 1D 12 8D 22 D0 50
0091:8D 0E 13 8D 12 13 AE 5B C0
0099:13 BD 0D 12 A0 00 99 13 84
00A1:13 C8 C0 08 D0 F8 BD 15 05
00A9:12 8D 1C 13 8D 1D 13 8D 73
00B1:1E 13 BD 1D 12 8D 23 D0 01
00B9:8D 1B 13 8D 1F 13 A9 04 33
00C1:85 FF A9 D5 85 FE 85 FC 5B
00C9:A9 D8 85 FD A2 00 A9 04 E8
00D1:85 24 A9 04 85 23 20 97 B7
00D9:10 A9 07 20 1B 11 C6 23 11
00E1:D0 F4 A9 80 20 1B 11 C6 2F
00E9:24 D0 E7 A5 2A D0 03 20 56
00F1:31 11 A9 01 85 2A A9 03 53
00F9:8D 15 D0 A9 BD 8D 03 D0 C9
0001:A9 D1 8D 02 D0 A2 C0 8E 53
0009:F9 07 E8 0E F8 07 A9 AA C5
0011:8D 00 D0 A9 7E 8D 01 D0 9F
0019:A9 01 8D 28 D0 A9 0F 8D 51
0021:27 D0 A9 00 8D 10 D0 A9 2C
0029:13 85 5B A0 00 B9 FE 12 96
0031:05 FE 85 FC A9 06 85 FF BA
0039:A9 DA 85 FD 20 7D 10 A9 2C
0041:77 99 45 13 C8 C0 04 D0 75
0049:E4 A9 BE 85 C5 A9 06 85 87
0051:5D 85 5F A9 0D 85 5E A9 E2
0059:7D 8D 59 13 A2 AA CA D0 14
0061:FD CE 20 13 D0 03 4C 65 EF
0069:0C CE 21 13 D0 03 4C 9E 58

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0B71:0C	CE	25	13	D0	03	4C	B9	FB	0E19:13	C9	7E	F0	11	C9	7D	F0	AB	10C1:8D	00	D4	A9	F3	8D	17	D4	B6	
0B79:0C	CE	29	13	D0	03	4C	A7	72	0E21:1A	C9	7B	F0	23	E8	A9	07	52	10C9:60	05	60	20	12	11	4C	D7	CE	
0B81:0D	4C	B6	0E	4C	2C	00	CE	E2	0E29:00	EC	10	4C	4E	0E	38	0A	00	10D1:10	05	60	20	09	11	38	A5	0C	
0B89:52	13	D0	03	4C	EA	0E	AD	AF	0E31:E9	06	AA	A9	9C	20	CA	10	00	10D9:FE	E5	60	85	FE	85	FC	A5	05	
0B91:2B	13	D0	F0	A4	52	AD	00	F4	0E39:4C	4F	0E	18	8A	69	06	AA	43	10E1:FF	E9	00	85	FF	18	69	D4	DC	
0B99:DC	00	10	99	2D	13	C9	7E	C3	0E41:A9	9C	20	EC	10	4C	4F	00	8A	10E9:85	FD	60	85	60	20	12	11	69	
0BA1:0F	0F	C9	7D	F0	1F	C9	7B	18	0E49:CA	A9	07	20	CA	10	86	5B	17	10F1:4C	F9	10	85	60	20	09	11	B7	
0BA9:F0	35	C9	77	F0	41	4C	06	61	0E51:00	2D	13	00	97	13	A9	00	3D	10F9:18	A5	FE	65	60	85	FE	85	62	
0BB1:0C	38	98	E9	06	A8	B9	2D	01	0E59:9D	2D	13	00	97	10	A5	FE	3B	1101:FC	A5	FE	69	00	4C	E4	10	AC	
0BB9:13	00	4A	A9	9C	20	D2	10	8C	0E61:85	5E	A5	FF	85	5F	4C	82	51	1109:A5	5C	85	FE	A5	5D	85	FF	63	
0BC1:A9	01	4C	D7	0B	18	98	69	47	0E69:0B	AE	12	D0	E0	C3	00	F9	37	1111:60	A5	5E	85	FE	A5	5F	4C	8A	
0BC9:06	A8	B9	2D	13	D0	36	A9	09	0E71:84	53	A0	00	99	28	D8	99	71	1119:0F	11	18	85	22	A5	FE	65	6D	
0BD1:9C	20	F4	10	A9	02	84	52	0E	0E79:0E	D9	99	F4	D9	99	DA	DA	5B	1121:22	85	FE	85	FC	A5	FF	69	D5	
0BD9:A0	09	A2	20	4C	19	0C	88	40	0E81:C8	C0	E6	D0	EF	8D	22	D0	E6	1129:00	85	FF	69	D4	85	FD	60	5C	
0BE1:B9	2D	13	D0	20	A9	07	10	65	0E89:8D	23	D0	8D	27	D0	8D	28	E7	1131:A2	00	A9	28	85	FE	A9	04	DB	
0BE9:D2	10	A9	03	4C	FD	0B	C8	0C	0E91:D0	AE	0C	A6	22	CA	86	22	95	1139:85	FF	A0	00	18	B1	FE	C9	81	
0BF1:B9	2D	13	00	10	A9	07	20	F4	0E99:0E	03	D4	00	49	FF	00	16	7C	1141:20	D0	2E	AD	1B	D4	C9	2D	35	
0BF9:F4	10	A9	04	84	52	A2	38	EE	0EA1:D4	04	26	A0	04	A2	00	CA	8D	1149:90	03	4C	72	11	AD	1B	D4	6F	
0C01:A0	05	4C	19	0C	A5	5C	85	FA	0EA9:D0	00	80	D0	FA	A4	26	88	0B	1151:29	03	69	24	91	FE	AD	1B	37	
0C09:FE	A5	5D	85	FF	A9	00	80	42	0EB1:D0	E1	A4	53	60	AD	2B	13	9B	1159:D4	29	0F	C9	0B	B0	F7	9D	57	
0C11:08	D4	85	57	85	59	A0	05	00	0EB9:F0	1D	A9	03	8D	08	D4	A5	D6	1161:00	42	A5	FE	9D	00	41	A5	CD	
0C19:8D	20	13	8D	2B	13	8E	2C	2C	0EC1:59	F0	05	C6	57	4C	CB	0E	65	1169:FF	69	D4	9D	00	40	E8	F0	1E	
0C21:13	84	29	A5	FE	85	C5	A5	CF	0EC9:E6	57	A5	57	C9	08	F0	0A	93	1171:18	E6	FE	8D	02	E6	FF	A5	97	
0C29:FF	00	5D	A5	C5	C9	3F	D0	4D	0ED1:C9	FE	F0	0D	8D	09	D4	4C	48	1179:FE	C9	BF	F0	03	4C	3E	11	6B	
0C31:30	A9	00	8D	18	D4	A9	00	57	0ED9:88	0B	A9	00	85	59	4C	D5	32	1181:A5	FF	C9	07	F0	03	4C	3E	8A	
0C39:8D	11	D0	A9	06	8D	20	D0	88	0EE1:0E	A9	01	4C	DD	0E	4C	D8	0F	1189:11	8E	3C	03	60	00	01	03	7B	
0C41:A5	C5	C9	40	D0	FA	A5	C5	5E	0EE9:0F	AD	5C	13	8D	52	13	AD	3F	1191:07	0F	1F	3F	7F	FF	FF	FF	CE	
0C49:C9	3F	D0	FA	A5	C5	C9	40	F7	0EF1:53	13	F0	F2	AE	57	13	E8	00	1199:FF	FF	FF	FF	FF	FF	FF	FF	B6	
0C51:D0	FA	A9	1F	8D	18	D4	A9	D7	0EF9:E8	8E	57	13	8E	00	D4	AE	17	11A1:F8	F0	F0	00	00	00	00	00	04	AC
0C59:00	8D	20	00	A9	5B	8D	11	CC	0F01:55	13	BD	E3	12	F0	1A	C9	D6	11A9:00	00	00	00	00	00	00	00	CB	
0C61:D0	4C	5D	0B	20	6B	00	4C	64	0F09:01	F0	03	4C	38	0F	00	00	E4	11B1:00	60	00	00	00	00	00	00	00	00
0C69:6A	0B	A9	6F	8D	20	13	00	59	0F11:D0	F0	03	4C	38	0F	AD	10	62	11B9:00	00	00	00	00	00	00	00	00	00
0C71:00	A2	00	18	BD	00	40	85	A7	0F19:D0	09	01	8D	10	D0	4C	38	6F	11C1:00	00	00	00	00	00	00	00	00	00
0C79:FF	BD	00	41	85	FE	86	26	70	0F21:0F	AC	00	D0	88	C8	0F	D0	46	11C9:3E	7C	F8	00	00	FF	7F	3F	87	
0C81:BD	00	42	AA	E8	0E	00	90	DE	0F29:C0	FF	F0	03	4C	38	0F	AD	05	11D1:1F	0F	07	03	01	00	00	00	22	
0C89:02	A2	00	8D	24	12	91	FE	B2	0F31:10	D0	29	FE	00	10	D0	BD	AC	11D9:0E	F0	F8	FC	FE	00	FF	FF	8F	
0C91:8A	A6	26	9D	00	42	E8	EC	FE	0F39:EF	12	F0	0D	C9	01	F0	03	F9	11E1:FF	FF	FF	FF	FF	21	22	22	EE	
0C99:3C	03	D0	D8	60	A9	E1	8D	33	0F41:4C	4D	0F	CE	01	D0	4C	4D	D8	11E9:63	21	22	22	63	23	22	22	7A	
0CA1:21	13	AD	28	D0	29	0F	C9	5A	0F49:0F	EE	01	00	EE	56	13	AE	7D	11F1:22	23	21	22	22	22	23	21	38	
0CA9:06	F0	08	A9	06	8D	20	D0	24	0F51:54	13	AD	56	13	D0	FB	12	93	11F9:22	A3	23	22	22	22	23	01	7D	
0CB1:4C	72	00	A9	01	4C	AE	0C	0E	0F59:F0	03	4C	90	0B	A9	00	8D	CF	1201:02	03	04	28	29	24	2B	2C	5E	
0CB9:A9	2A	8D	25	13	20	C9	0C	ED	0F61:56	13	EE	54	13	EE	55	13	A4	1209:50	51	52	53	0E	02	03	0F	B6	
0CC1:AD	23	13	F0	25	4C	7A	0B	45	0F69:AD	54	13	C9	03	F0	03	4C	A0	1211:04	0A	0C	0E	06	09	05	0C	86	
0CC9:AE	24	13	AC	23	13	E8	00	87	0F71:90	0B	A9	00	8D	53	13	4C	FB	1219:06	00	0B	06	03	08	0D	01	57	
0CD1:30	F0	08	00	24	13	8A	99	44	0F79:90	0B	A9	00	8D	53	13	A5	00	1221:0E	0F	03	0B	04	0C	0F	07	96	
0CD9:C4	07	60	A9	20	99	4C	07	B4	0F81:58	38	E9	06	AA	18	8A	79	BB	1229:01	07	0F	0C	04	0B	06	00	8A	
0CE1:88	8C	23	13	A2	28	8E	24	ED	0F89:02	13	AA	BD	20	13	F0	03	39	1231:7F	FE	00	FE	FC	01	FF	F8	B9	
0CE9:13	60	AE	22	13	CA	CA	F0	E5	0F91:EE	58	13	C8	C0	04	D0	EE	D2	1239:03	FF	F0	07	FE	E0	0F	FE	0F	
0CF1:38	8E	22	13	A9	20	9D	11	59	0F99:AD	58	13	C9	00	F0	6F	A6	0D	1241:C0	1F	FF	80	3F	FF	00	7F	0F	
0CF9:04	A9	00	8D	08	D4	20	AD	D8	0FA1:58	AD	1B	D4	C9	40	90	13	00	1249:FE	00	FF	FC	00	00	78	00	AD	
0D01:10	A9	41	8D	04	D4	A9	04	59	0FA9:C9	80	90	1E	C9	E0	00	29	5C	1251:00	FC	00	00	FC	00	00	00	FC	99
0D09:8D	01	D4	A9	F0	85	22	A9	EA	0FBI:0E	BD	2D	13	D0	E0	CA	00	03	1259:00	00	78	00	00	00	00	00	00	8C
0D11:CA	8D	96	0E	A0	0A	A9	02	2A	0FB9:4C	E2	0F	38	8A	E9	06	AA	CE	1261:00	00	00	00	00	00	00	00	85	
0D19:20	6A	0E	A9	07	20	6A	00	D5	0FC1:BD	2D	13	D0	D4	A0	00	4C	1F	1269:13	03	0F	12	05	08	09	07	3C	
0D21:88	D0	F3	0C	01	D4	4C	28	17	0FC9:E2	0F	18	00	69	06	AA	BD	3F	1271:08	20	14	09	0D	05	20	7D	EE	
0D29:0A	A0	00	A9	41	8D	00	D4	28	0FD1:00	13	D0	CB	A0	03	4C	E2	AE	1279:7D	3C	20	7D	7D	3C	20	7D	E1	
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0D41:A9	E8	8D	96	0E	A9	32	00	00	0FE9:8D	54	13	8D	56	13	8D	06	3F	1291:3C	20	22	20	20	1B	03	10	B2	
0D49:22	B9	24	12	20	6A	0E	C8	18	0FF1:D4	8D	57	13	A9	05	8D	01	77	1299:31	39	38	38	20	03	0F	0D	67	
0D51:C0	0D	00	F5	A9	00	8D	15	06	0FF9:D4	A9	20	8D	04	D4	A9	0A	9A	12A1:10	15	14	05	10	12	05	13	CB	
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Computer's Gazette
Dec., 1987

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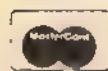
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







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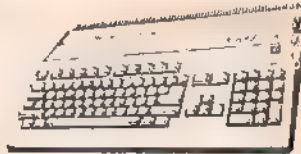
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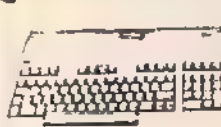
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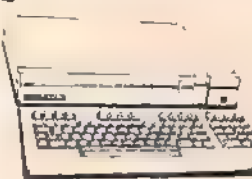
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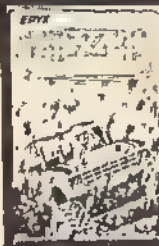
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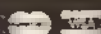
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How To Type In COMPUTE!'s Gazette Programs

Each month, COMPUTE!'s Gazette publishes programs for the Commodore 128, 64, Plus/4, and 16. Each program is clearly marked by title and version. Be sure to type in the correct version for your machine. All 64 programs run on the 128 in 64 mode. Be sure to read the instructions in the corresponding article. This can save time and eliminate any questions which might arise after you begin typing.

We frequently publish two programs designed to make typing easier: The Automatic Proofreader, and MLX, designed for entering machine language programs.

When entering a BASIC program, be especially careful with DATA statements as they are extremely sensitive to errors. A mistyped number in a DATA statement can cause your machine to "lock up" (you'll have no control over the computer). If this happens, the only recourse is to turn your computer off then on, erasing what was in memory. So be sure to *save a program before you run it*. If your computer crashes, you can always reload the program and look for the error.

Special Characters

Most of the programs listed in each issue contain special control characters. To facilitate typing in any programs from the GAZETTE, use the following listing conventions.

The most common type of control characters in our listings appear as words within braces: {DOWN} means to press the cursor down key; {5 SPACES} means to press the space bar five times.

To indicate that a key should be *shifted* (hold down the SHIFT key while pressing another key), the character is underlined. For example, A means hold down the SHIFT key and press A. You may see strange characters on your screen, but that's to be expected. If you find a number followed by an underlined key enclosed in braces (for example, {8 A}), type the key as many times as indicated (in our example, enter eight SHIFTed A's).

If a key is enclosed in special brackets, [F], hold down the Commodore key (at the lower left corner of the keyboard) and press the indicated character.

Rarely, you'll see a single letter of the alphabet enclosed in braces.

This can be entered on the Commodore 64 by pressing the CTRL key while typing the letter in braces. For example, {A} means to press CTRL-A.

The Quote Mode

Although you can move the cursor around the screen with the CRSR keys, often a programmer will want to move the cursor under program control. This is seen in examples such as {LEFT}, and {HOME} in the program listings. The only way the computer can tell the difference between direct and programmed cursor control is *the quote mode*.

Once you press the quote key, you're in quote mode. This mode can be confusing if you mistype a character and cursor left to change it. You'll see a reverse video character (a graphics symbol for cursor left). In this case, you can use the DELETE key to back up and edit the line. Type another quote and you're out of quote mode. If things really get confusing, you can exit quote mode simply by pressing RETURN. Then just cursor up to the mistyped line and fix it.

When You Read:	Press:	See:
{CLR}	SHIFT CLR/HOME	
{HOME}	CLR/HOME	
{UP}	SHIFT ↑ CRSR	
{DOWN}	↑ CRSR ↓	
{LEFT}	SHIFT ← CRSR	
{RIGHT}	← CRSR →	
{RVS}	CTRL 9	
{OFF}	CTRL 0	
{BLK}	CTRL 1	
{WHT}	CTRL 2	
{RED}	CTRL 3	
{CYN}	CTRL 4	

When You Read:	Press:	See:
{PUR}	CTRL 5	
{GRN}	CTRL 6	
{BLU}	CTRL 7	
{YEL}	CTRL 8	
{ F1 }	F1	
{ F2 }	SHIFT F1	
{ F3 }	F3	
{ F4 }	SHIFT F3	
{ F5 }	F5	
{ F6 }	SHIFT F5	
{ F7 }	F7	
{ F8 }	SHIFT F7	

When You Read:	Press:	See:
←	←	
↑	SHIFT ↑	

For Commodore 64 Only

[F1]	[COMMODORE]	1	
[F2]	[COMMODORE]	2	
[F3]	[COMMODORE]	3	
[F4]	[COMMODORE]	4	
[F5]	[COMMODORE]	5	
[F6]	[COMMODORE]	6	
[F7]	[COMMODORE]	7	
[F8]	[COMMODORE]	8	

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The Automatic Proofreader

Philip I. Nelson

"The Automatic Proofreader" helps you type in program listings for the 128, 64, Plus/4, and 16 and prevents nearly every kind of typing mistake.

Type in the Proofreader *exactly* as listed. Since the program can't check itself, type carefully to avoid mistakes. Don't omit any lines, even if they contain unfamiliar commands. After finishing, save a copy or two on disk or tape before running it. This is important because the Proofreader erases the BASIC portion of itself when you run it, leaving only the machine language portion in memory.

Next, type RUN and press RETURN. After announcing which computer it's running on, the Proofreader displays the message "Proofreader Active". Now you're ready to type in a BASIC program.

Every time you finish typing a line and press RETURN, the Proofreader displays a two-letter checksum in the upper-left corner of the screen. Compare this result with the two-letter checksum printed to the left of the line in the program listing. If the letters match, it's almost certain the line was typed correctly. If the letters don't match, check for your mistake and correct the line.

The Proofreader ignores spaces not enclosed in quotes, so you can omit or add spaces between keywords and still see a matching checksum. However, since spaces inside quotes are almost always significant, the Proofreader pays attention to them. For example, 10 PRINT "THIS IS BASIC" will generate a different checksum than 10 PRINT "THIS ISBA SIC".

A common typing error is transposition—typing two successive characters in the wrong order, like PIRNT instead of PRINT or 64378 instead of 64738. The Proofreader is sensitive to the *position* of each character within the line and thus catches transposition errors.

The Proofreader does *not* accept keyword abbreviations (for example, ? instead of PRINT). If you prefer to use abbreviations, you can still check the line by LISTing it after typing it in, moving the cursor back to the line, and pressing RETURN. LISTing the line

substitutes the full keyword for the abbreviation and allows the Proofreader to work properly. The same technique works for rechecking programs you've already typed in.

If you're using the Proofreader on the Commodore 128, Plus/4, or 16, *do not perform any GRAPHIC commands while the Proofreader is active*. When you perform a command like GRAPHIC 1, the computer moves everything at the start of BASIC program space—including the Proofreader—to another memory area, causing the Proofreader to crash. The same thing happens if you run any program with a GRAPHIC command while the Proofreader is in memory.

Though the Proofreader doesn't interfere with other BASIC operations, it's a good idea to disable it before running another program. However, the Proofreader is purposely difficult to dislodge: It's not affected by tape or disk operations, or by pressing RUN/STOP-RESTORE. The simplest way to disable it is to turn the computer off then on. A gentler method is to SYS to the computer's built-in reset routine (SYS 65341 for the 128, 64738 for the 64, and 65526 for the Plus/4 and 16). These reset routines erase any program in memory, so be sure to save the program you're typing in before entering the SYS command.

If you own a Commodore 64, you may already have wondered whether the Proofreader works with other programming utilities like "MetaBASIC." The answer is generally yes, *if you're using a 64 and activate the Proofreader after installing the other utility*. For example, first load and activate MetaBASIC, then load and run the Proofreader.

When using the Proofreader with another utility, you should disable *both* programs before running a BASIC program. While the Proofreader seems unaffected by most utilities, there's no way to promise that it will work with any and every combination of utilities you might want to use. The more utilities activated, the more fragile the system becomes.

The New Automatic Proofreader

```
10 VEC=PEEK(772)+256*PEEK(773)
:LO=43:HI=44
```

```
20 PRINT "AUTOMATIC PROOFREADER FOR ";IF VEC=42364 THEN [SPACE]PRINT "C-64"
30 IF VEC=50556 THEN PRINT "VI C-20"
40 IF VEC=35158 THEN GRAPHIC CLR:PRINT "PLUS/4 & 16"
50 IF VEC=17165 THEN LO=45:HI=46:GRAPHIC CLR:PRINT "128"
60 SA=(PEEK(LO)+256*PEEK(HI))+6:ADR=SA
70 FOR J=0 TO 166:READ BYT:POKE ADR,BYT:ADR=ADR+1:CHK=CHK+BYT:NEXT
80 IF CHK<>20570 THEN PRINT "**ERROR* CHECK TYPING IN DATA STATEMENTS":END
90 FOR J=1 TO 5:READ RF,LF,HF:RS=SA+RF:HB=INT(RS/256):LB=RS-(256*HB)
100 CHK=CHK+RF+LF+HF:POKE SA+LF,HB:POKE SA+HF,HB:NEXT
110 IF CHK<>22054 THEN PRINT "**ERROR* RELOAD PROGRAM AND [SPACE]CHECK FINAL LINE":END
120 POKE SA+149,PEEK(772):POKE SA+150,PEEK(773)
130 IF VEC=17165 THEN POKE SA+14,22:POKE SA+18,23:POKE SA+29,224:POKE SA+139,224
140 PRINT CHR$(147):CHR$(17):"PROOFREADER ACTIVE":SYS SA
150 POKE HI,PEEK(HI)+1:POKE (PEEK(LO)+256*PEEK(HI))-1,0:N
160 DATA 120,169,73,141,4,3,16
170 DATA 88,96,165,20,133,167,165,21,133,168,169
180 DATA 0,141,0,255,162,31,181,199,157,227,3
190 DATA 202,16,248,169,19,32,210,255,169,18,32
200 DATA 210,255,160,0,132,180,132,176,136,230,180
210 DATA 200,185,0,2,240,46,201,34,200,8,72
220 DATA 165,176,73,255,133,176,104,72,201,32,208
230 DATA 7,165,176,208,3,104,208,226,104,166,180
240 DATA 24,165,167,121,0,2,133,167,165,168,105
250 DATA 0,133,168,202,208,239,240,202,165,167,69
260 DATA 168,72,41,15,168,185,211,3,32,210,255
270 DATA 104,74,74,74,168,185,211,3,32,210
280 DATA 255,162,31,183,227,3,149,199,202,16,248
290 DATA 169,146,32,210,255,76,86,137,65,66,67
300 DATA 68,69,70,71,72,74,75,77,80,81,82,83,88
310 DATA 11,2,7,167,31,32,151,116,117,151,128,129,167,136,137
```


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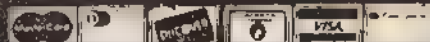
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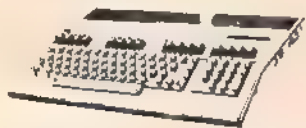
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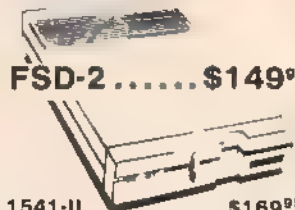
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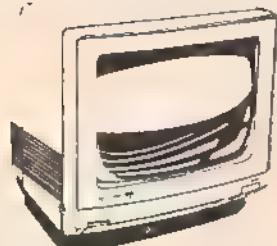


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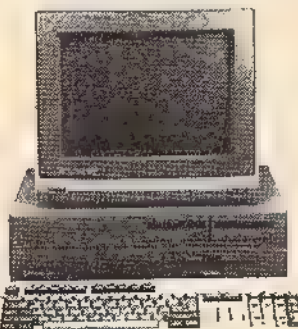
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MLX Machine Language Entry Program For Commodore 64

Ottis Cowper

"MLX" is a labor-saving utility that allows almost fail-safe entry of Commodore 64 machine language programs.

Type in and save some copies of MLX—you'll want to use it to enter future ML programs from COMPUTE!'s GAZETTE. When you're ready to enter an ML program, load and run MLX. It asks you for a starting address and an ending address. These addresses appear in the article accompanying the MLX-format program listing you're typing.

If you're unfamiliar with machine language, the addresses (and all other values you enter in MLX) may appear strange. Instead of the usual decimal numbers you're accustomed to, these numbers are in hexadecimal—a base 16 numbering system commonly used by ML programmers. Hexadecimal—hex for short—includes the numerals 0-9 and the letters A-F. But don't worry—even if you know nothing about ML or hex, you should have no trouble using MLX.

After you enter the starting and ending addresses, you'll be offered the option of clearing the workspace. Choose this option if you're starting to enter a new listing. If you're continuing a listing that's partially typed from a previous session, don't choose this option.

A functions menu will appear. The first option in the menu is ENTER DATA. If you're just starting to type in a program, pick this. Press the E key, and type the first number in the first line of the program listing. If you've already typed in part of a program, type the line number where you left off typing at the end of the previous session (be sure to load the partially completed program before you resume entry). In any case, make sure the address you enter corresponds to the address of a line in the listing you are entering. Otherwise, you'll be unable to enter the data correctly. If you pressed E by mistake, you can return to the command menu by pressing RETURN alone when asked for the address. (You can get back to the menu from most options by pressing RETURN with no other input.)

Entering A Listing

Once you're in Enter mode, MLX prints the address for each program line for you. You then type in all nine numbers on that line, beginning with the first two-digit number after the colon (:). Each line represents eight data bytes and

a checksum. Although an MLX-format listing appears similar to the "hex dump" listings from a machine language monitor program, the extra checksum number on the end allows MLX to check your typing.

When you enter a line, MLX recalculates the checksum from the eight bytes and the address and compares this value to the number from the ninth column. If the values match, you'll hear a bell tone, the data will be added to the workspace area, and the prompt for the next line of data will appear. But if MLX detects a typing error, you'll hear a low buzz and see an error message. The line will then be redisplayed for editing.

Invalid Characters Banned

Only a few keys are active while you're entering data, so you may have to unlearn some habits. You *do not* type spaces between the columns; MLX automatically inserts these for you. You *do not* press RETURN after typing the last number in a line; MLX automatically enters and checks the line after you type the last digit.

Only the numerals 0-9 and the letters A-F can be typed in. If you press any other key (with some exceptions noted below), you'll hear a warning buzz. To simplify typing, the numeric keypad modification from the March 1986 "Bug-Swatter" column is now incorporated in the listing. The keypad is active only while entering data. Addresses must be entered with the normal letter and number keys. The figure below shows the keypad configuration:

7	8	9	0
4 U	5 I	6 O	F P
1 J	2 K	3 L	E ;
A M	B ,	C .	D /
0 Space			

MLX checks for transposed characters. If you're supposed to type in A0 and instead enter 0A, MLX will catch your mistake. There is one error that can slip past MLX: Because of the

checksum formula used, MLX won't notice if you accidentally type FF in place of 00, and vice versa. And there's a very slim chance that you could garble a line and still end up with a combination of characters that adds up to the proper checksum. However, these mistakes should not occur if you take reasonable care while entering data.

Editing Features

To correct typing mistakes before finishing a line, use the INST/DEL key to delete the character to the left of the cursor. (The cursor-left key also deletes.) If you mess up a line really badly, press CLR/HOME to start the line over. The RETURN key is also active, but only before any data is typed on a line. Pressing RETURN at this point returns you to the command menu. After you type a character of data, MLX disables RETURN until the cursor returns to the start of a line. Remember, you can press CLR/HOME to quickly get to a line number prompt.

More editing features are available when correcting lines in which MLX has detected an error. To make corrections in a line that MLX has redisplayed for editing, compare the line on the screen with the one printed in the listing, then move the cursor to the mistake and type the correct key. The cursor left and right keys provide the normal cursor controls. (The INST/DEL key now works as an alternative cursor-left key.) You cannot move left beyond the first character in the line. If you try to move beyond the rightmost character, you'll reenter the line. During editing, RETURN is active; pressing it tells MLX to recheck the line. You can press the CLR/HOME key to clear the entire line if you want to start from scratch, or if you want to get to a line number prompt to use RETURN to get back to the menu.

Display Data

The second menu choice, DISPLAY DATA, examines memory and shows the contents in the same format as the program listing (including the checksum). When you press D, MLX asks you for a starting address. Be sure that the starting address you give corresponds to a line number in the listing. Otherwise, the checksum display will be meaningless. MLX displays program lines until it reaches the end of the program, at which point the menu is redis-

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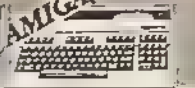
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played. You can pause the display by pressing the space bar. (MLX finishes printing the current line before halting.) Press space again to restart the display. To break out of the display and get back to the menu before the ending address is reached, press RETURN.

Other Menu Options

Two more menu selections let you save programs and load them back into the computer. These are SAVE FILE and LOAD FILE; their operation is quite straightforward. When you press S or L, MLX asks you for the filename. You'll then be asked to press either D or T to select disk or tape.

You'll notice the disk drive starting and stopping several times during a load or save. Don't panic; this is normal behavior. MLX opens and reads from or writes to the file instead of using the usual LOAD and SAVE commands. Disk users should also note that the drive prefix 0: is automatically added to the filename (line 750), so this should not be included when entering the name. This also precludes the use of @ for Save-with-Replace, so remember to give each version you save a different name.

Remember that MLX saves the entire workspace area from the starting address to the ending address, so the save or load may take longer than you might expect if you've entered only a small amount of data from a long listing. When saving a partially completed listing, make sure to note the address where you stopped typing so you'll know where to resume entry when you reload.

MLX reports the standard disk or tape error messages if any problems are detected during the save or load. (Tape users should bear in mind that Commodore computers are never able to detect errors during a save to tape.) MLX also has three special load error messages: INCORRECT STARTING ADDRESS, which means the file you're trying to load does not have the starting address you specified when you ran MLX; LOAD ENDED AT address, which means the file you're trying to load ends before the ending address you specified when you started MLX; and TRUNCATED AT ENDING ADDRESS, which means the file you're trying to load extends beyond the ending address you specified when you started MLX. If you see one of these messages and feel certain that you've loaded the right file, exit and rerun MLX, being careful to enter the correct starting and ending addresses.

The QUIT menu option has the obvious effect—it stops MLX and enters BASIC. The RUN/STOP key is disabled, so the Q option lets you exit the

program without turning off the computer. (Of course, RUN/STOP-RESTORE also gets you out.) You'll be asked for verification; press Y to exit to BASIC, or any other key to return to the menu. After quitting, you can type RUN again and reenter MLX without losing your data, as long as you don't use the clear workspace option.

The Finished Product

When you've finished typing all the data for an ML program and saved your work, you're ready to see the results. The instructions for loading and using the finished product vary from program to program. Some ML programs are designed to be loaded and run like BASIC programs, so all you need to type is LOAD "filename",8 for disk or LOAD "filename" for tape, and then RUN. Such programs will usually have a starting address of 0801 for the 64. Other programs must be reloaded to specific addresses with a command such as LOAD "filename",8,1 for disk or LOAD "filename",1,1 for tape, then started with a SYS to a particular memory address. On the Commodore 64, the most common starting address for such programs is 49152, which corresponds to MLX address C000. In either case, you should always refer to the article which accompanies the ML listing for information on loading and running the program.

An Ounce Of Prevention

By the time you finish typing in the data for a long ML program, you may have several hours invested in the project. Don't take chances—use our "Automatic Proofreader" to type the new MLX, and then test your copy thoroughly before first using it to enter any significant amount of data. Make sure all the menu options work as they should. Enter fragments of the program starting at several different addresses, then use the Display option to verify that the data has been entered correctly. And be sure to test the Save and Load options several times to insure that you can recall your work from disk or tape. Don't let a simple typing error in the new MLX cost you several nights of hard work.

MLX For Commodore 64

```
SS 10 REM VERSION 1.1: LINES 8
    30,950 MODIFIED, LINES 4
    85-487 ADDED
EK 100 POKE 56,50:CLR:DIM IN$,
    1,J,A,B,A$,B$,A(7),N$,
DM 110 C4=48:C6=16:C7=7:Z2=2:Z
    4=254:Z5=255:Z6=256:Z7=
    127
CJ 120 FA=PEEK(45)+Z6*PEEK(46)
    :BS=PEEK(55)+Z6*PEEK(56
```

```
    ):HS="0123456789ABCDEF"
SB 130 RS=CHR$(13):LS="{LEFT}"
    :SS=" " :DS=CHR$(20):Z$=
    CHR$(0):T$=" [13 RIGHT]"
CQ 140 SD=54272:FOR I=SD TO SD
    +23:POKE I,0:NEXT I:POKE
    {SPACE}SD+24,15:POKE 78
    8,52
FC 150 PRINT"[CLR]"CHR$(142)CH
    R$(8):POKE 53280,15:POK
    E 53281,15
EJ 160 PRINT T$ {RED}{RVS}
    {2 SPACES}{8 @}
    {2 SPACES}"SPC(28)"
    {2 SPACES}{OFF}{BLU} ML
    X 11 {RED}{RVS}
    {2 SPACES}"SPC(28)"
    {12 SPACES}{BLU}"
FR 170 PRINT"[3 DOWN]
    {3 SPACES}COMPUTE!'S MA
    CHINE LANGUAGE EDITOR
    {3 DOWN}"
JB 180 PRINT"[BLK]STARTING ADD
    RESS[4]":GOSUB300:SA=A
    D:GOSUB1040:IF F THEN18
    0
GF 190 PRINT"[BLK]{2 SPACES}EN
    DING ADDRESS[4]":GOSUB
    300:EA=AD:GOSUB1030:IF
    {SPACE}F THEN190
KR 200 INPUT"[3 DOWN]{BLK}CLEA
    R WORKSPACE [Y/N][4]":A
    $:IF LEFT$(A$,1)<>"Y"TH
    EN220
PG 210 PRINT"[2 DOWN]{BLU}WORK
    ING...":FORI=BS TO BS+
    EA-SA+7:POKE I,0:NEXT I:P
    RINT"DONE"
DR 220 PRINTTAB(10)"[2 DOWN]
    {BLK}{RVS} MLX COMMAND
    {SPACE}MENU {DOWN}[4]":
    PRINT T$ {RVS}E{OFF}NTE
    R DATA"
BD 230 PRINT T$ {RVS}D{OFF}ISP
    LAY DATA:PRINT T$
    {RVS}L{OFF}LOAD FILE"
JS 240 PRINT T$ {RVS}S{OFF}AVE
    FILE:PRINT T$ {RVS}Q
    {OFF}UIT[2 DOWN]{BLK}"
JH 250 GET A$:IF A$=N$ THEN250
HE 260 A=0:FOR I=1 TO 5:IF A$=
    MID$( "EDLSQ",I,1) THEN A
    =1:I=5
PD 270 NEXT:ON A GOTO420,610,6
    90,700,280:GOSUB1060:GO
    TO250
EJ 280 PRINT"[RVS] QUIT ":INPU
    T"[DOWN][4]ARE YOU SURE
    [Y/N]":A$:IF LEFT$(A$,
    1)<>"Y"THEN220
EM 290 POKE SD+24,0:END
JX 300 IN$=N$:AD=0:INPUTIN$:IF
    LEN(IN$)<>4 THENRETURN
KF 310 B$=IN$:GOSUB320:AD=A:B$
    =MID$(IN$,3):GOSUB320:A
    D=AD*256+A:RETURN
320 A=0:FOR J=1 TO 2:A$=MID
    $(B$,J,1):B=ASC(A$)-C4+
    (A$="0")*C7:A=A*C6+B
JA 330 IF B<0 OR B>15 THEN AD=
    0:A=-1:J=2
GX 340 NEXT:RETURN
CH 350 B=INT(A/C6):PRINT MID$(
    H$,B+1,1):B=A-B*C6:PRI
    NT MID$(H$,B+1,1):RETI
    RN
RR 360 A=INT(AD/Z6):GOSUB350:A
    =AD-A*Z6:GOSUB350:PRINT
    " ":
III 370 CK=INT(AD/Z6):CK=AD-Z4*
    CK+Z5*(CK>Z7):GOTO390
PX 380 CK=CK+Z2+Z5*(CK>Z7)+A
```


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```

JC 390 CK=CK+Z5*(CK>Z5):RETURN
QS 400 PRINT"[DOWN]STARTING AT
[43]";:GOSUB300:IF IN$<>
N$ THEN GOSUB1030:IF P
[SPACE]THEN400
EX 410 RETURN
HD 420 PRINT"[RVS] ENTER DATA
[SPACE]";:GOSUB400:IF IN
$=N$ THEN220
JK 430 OPEN3,3:PRINT
SK 440 POKE190,0:GOSUB360:IF F
THEN PRINT IN$:PRINT"
[UP]15 RIGHT";
GC 450 FOR I=0 TO 24 STEP 3:B$
=SS:FOR J=1 TO 2:IF F T
HEN B$=MID$(IN$,I+J,1)
HA 460 PRINT"[RVS]"B$LS;:IF I<
24THEN PRINT"[OFF]";
HD 470 GET A$:IF A$=N$ THEN470
FK 480 IF(A$>"/"ANDAS<"")OR(A
$>"@ANDAS<"G")THEN540
GS 485 A=- (A$="M")-2*(A$=",")-
3*(A$=".")-4*(A$="")-5
*(A$="J")-6*(A$="K")
FX 486 A=A-7*(A$="L")-8*(A$="")
-9*(A$="U")-10*(A$="I
")-11*(A$="O")-12*(A$="
P")
CM 487 A=A-13*(A$=SS):IF A THE
N A$=MID$( "ABCD123E456F
0",A,1):GOTO 540
MP 490 IF A$=R$ AND((I=0)AND(J
=1)OR F)THEN PRINT B$;:
J=2:NEXT I=24:GOTO550
KC 500 IF A$="{HOME}" THEN PRI
NT B$:J=2:NEXT I=24:NEX
T:F=0:GOTO440
MX 510 IF(A$="{RIGHT}")ANDF TH
ENPRINT B$LS;:GOTO540
GK 520 IF A$<>L$ AND A$<>D$ OR
((I=0)AND(J=1))THEN GOS
UB1060:GOTO470
HG 530 A$=L$+S$+L$:PRINT B$LS;
:J=2-J:IF J THEN PRINT
[SPACE]L$;:I=I-3
QS 540 PRINT A$;:NEXT J:PRINT
[SPACE]S$;
PM 550 NEXT I:PRINT:PRINT"[UP]
[5 RIGHT]";:INPUT#3,IN$
:IF IN$=N$ THEN CLOSE3:
GOTO220
QC 560 FOR I=1 TO 25 STEP3:B$=
MID$(IN$,I):GOSUB320:IF
I<25 THEN GOSUB380:A(I
/3)=A
PK 570 NEXT I:IF A<>CK THEN GOSU
B1060:PRINT"[BLK][RVS]
[SPACE]ERROR: REENTER L
INE [43]":F=1:GOTO440
HJ 580 GOSUB1080:B=BS+AD-SA:FO
R I=0 TO 7:POKE B+I,A(I
):NEXT
QQ 590 AD=AD+8:IF AD>EA THEN C
LOSE3:PRINT"[DOWN][BLU]
** END OF ENTRY **[BLK]
[2 DOWN]":GOTO700
GQ 600 F=0:GOTO440
QA 610 PRINT"[CLR][DOWN][RVS]
[SPACE]DISPLAY DATA ";G
OSUB400:IF IN$=N$ THEN2
20
RJ 620 PRINT"[DOWN][BLU]PRESS,
[RVS]SPACE[OFF] TO PAU
SE, [RVS]RETURN[OFF] TO
BREAK[43][DOWN]"
KS 630 GOSUB360:B=BS+AD-SA:FOR
I=BTO B+7:A=PEEK(I):GOS
UB350:GOSUB380:PRINT S$
,
CC 640 NEXT I:PRINT"[RVS]";:A=CK
:GOSUB350:PRINT
KH 650 F=1:AD=AD+8:IF AD>EA TH

```

```

ENPRINT"[DOWN][BLU]** E
ND OF DATA **":GOTO220
KC 660 GET A$:IF A$=R$ THEN GO
SUB1080:GOTO220
EQ 670 IF A$=S$ THEN F=F+1:GOS
UB1080
AD 680 ONFGOTO630,660,630
CM 690 PRINT"[DOWN][RVS] LOAD
[SPACE]DATA ";OP=1:GOTO
710
PC 700 PRINT"[DOWN][RVS] SAVE
[SPACE]FILE ";OP=0
RX 710 IN$=N$:INPUT"[DOWN]FILE
NAME[43]";IN$:IF IN$=N$
[SPACE]THEN220
PR 720 F=0:PRINT"[DOWN][BLK]
[RVS]T[OFF]APE OR [RVS]
D[OFF]ISK:"[43]";
FP 730 GET A$:IF A$="T"THEN PR
INT"T[DOWN]":GOTO880
HQ 740 IF A$<>"D"THEN730
HH 750 PRINT"D[DOWN]":OPEN15,8
,15,"I0":B=EA-SA:IN$="
0":IN$:IF OP THENB10
SQ 760 OPEN 1,8,0,IN$+"P,W":G
OSUB860:IF A THEN220
FJ 770 AH=INT(SA/256):AL=SA-(A
H*256):PRINT#1,CHRS(AL)
;CHRS(AH);
PE 780 FOR I=0 TO B:PRINT#1,CH
RS(PEEK(BS+I));:IF ST T
HENH000
FC 790 NEXT:CLOSE1:CLOSE15:GOT
O940
GS 800 GOSUB1060:PRINT"[DOWN]
[BLK]ERROR DURING SAVE:
[43]":GOSUB860:GOTO220
MA 810 OPEN 1,8,8,IN$+"P,R":G
OSUB860:IF A THEN220
GE 820 GET#1,A$,B$:AD=ASC(A$+Z
$)+256*ASC(B$+Z$):IF AD
<>SA THEN F=1:GOTO850
RX 830 FOR I=0 TO B:GET#1,A$:P
OKE BS+I,ASC(A$+Z$):IF(
I<B)AND ST THEN F=2:AD
=I:I=B
FA 840 NEXT:IF ST<>64 THEN F=3
FQ 850 CLOSE1:CLOSE15:ON ABS(F
+0)+1 GOTO960,970
SA 860 INPUT#15,A,A$:IF A THEN
CLOSE1:CLOSE15:GOSUB10
60:PRINT"[RVS]ERROR: "A
$
GQ 870 RETURN
EJ 880 POKE183,PEEK(FA+2):POKE
187,PEEK(FA+3):POKE188,
PEEK(FA+4):IFOP=0THEN92
0
HJ 890 SYS 63466:IF(PEEK(783)A
ND1)THEN GOSUB1060:PRIN
T"[DOWN][RVS] FILE NOT
[SPACE]FOUND ":GOTO690
CS 900 AD=PEEK(829)+256*PEEK(8
30):IF AD<>SA THEN F=1:
GOTO970
SC 910 A=PEEK(831)+256*PEEK(83
2)-1:F=F-2*(A<EA)-3*(A>
EA):AD=A-AD:GOTO930
KM 920 A=SA:B=EA+1:GOSUB1010:P
OKE780,3:SYS 63338
JF 930 A=BS:B=BS+(EA-SA)+1:GOS
UB1010:ON OF GOTO950:SY
S 63591
AE 940 GOSUB1080:PRINT"[BLU]**
SAVE COMPLETED **":GOT
O220
XP 950 POKE147,0:SYS 63562:IF
[SPACE]ST>0 THEN970
FR 960 GOSUB1080:PRINT"[BLU]**
LOAD COMPLETED **":GOT
O220
DP 970 GOSUB1060:PRINT"[BLK]

```

```

[RVS]ERROR DURING LOAD:
[DOWN][43]":ON F GOSUB98
0,990,1000:GOTO220
PP 980 PRINT"INCORRECT STARTIN
G ADDRESS (";:GOSUB360:
PRINT")":RETURN
GR 990 PRINT"LOAD ENDED AT ";:
AD=SA+AD:GOSUB360:PRINT
D$:RETURN
FD 1000 PRINT"TRUNCATED AT END
ING ADDRESS":RETURN
RX 1010 AH=INT(A/256):AL=A-(AH
*256):POKE193,AL:POKE1
94,AH
FF 1020 AH=INT(B/256):AL=B-(AH
*256):POKE174,AL:POKE1
75,AH:RETURN
FX 1030 IF AD<SA OR AD>EA THEN
[43]
HA 1040 IF(AD>511 AND AD<40960
)OR(AD>49151 AND AD<53
248)THEN GOSUB1080:F=0
:RETURN
HC 1050 GOSUB1060:PRINT"[RVS]
[SPACE]INVALID ADDRESS
[DOWN][BLK]":F=1:RETU
RN
AR 1060 POKE SD+5,31:POKE SD+6
,208:POKE SD,240:POKE
[SPACE]SD+1,4:POKE SD+
4,33
DX 1070 FOR S=1 TO 100:NEXT:GO
TO1090
PF 1080 POKE SD+5,8:POKE SD+6,
240:POKE SD,0:POKE SD+
1,90:POKE SD+4,17
AC 1090 FOR S=1 TO 100:NEXT:PO
KE SD+4,0:POKE SD,0:PO
KE SD+1,0:RETURN

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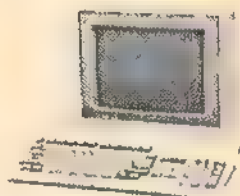
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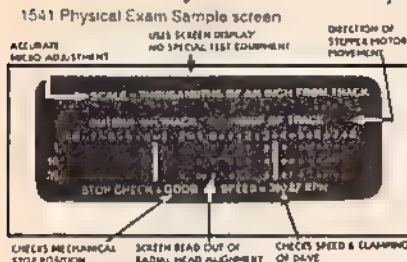
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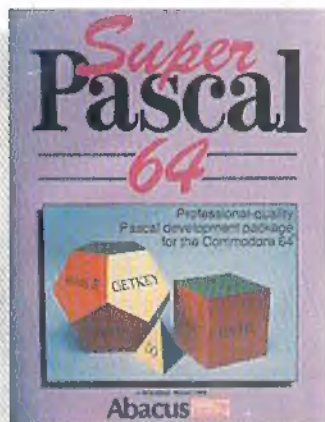
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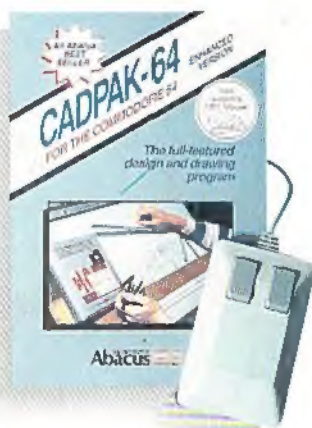
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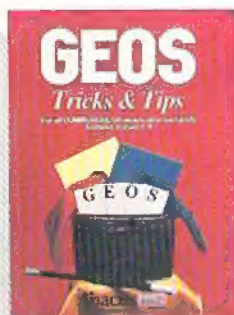


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